

AIM



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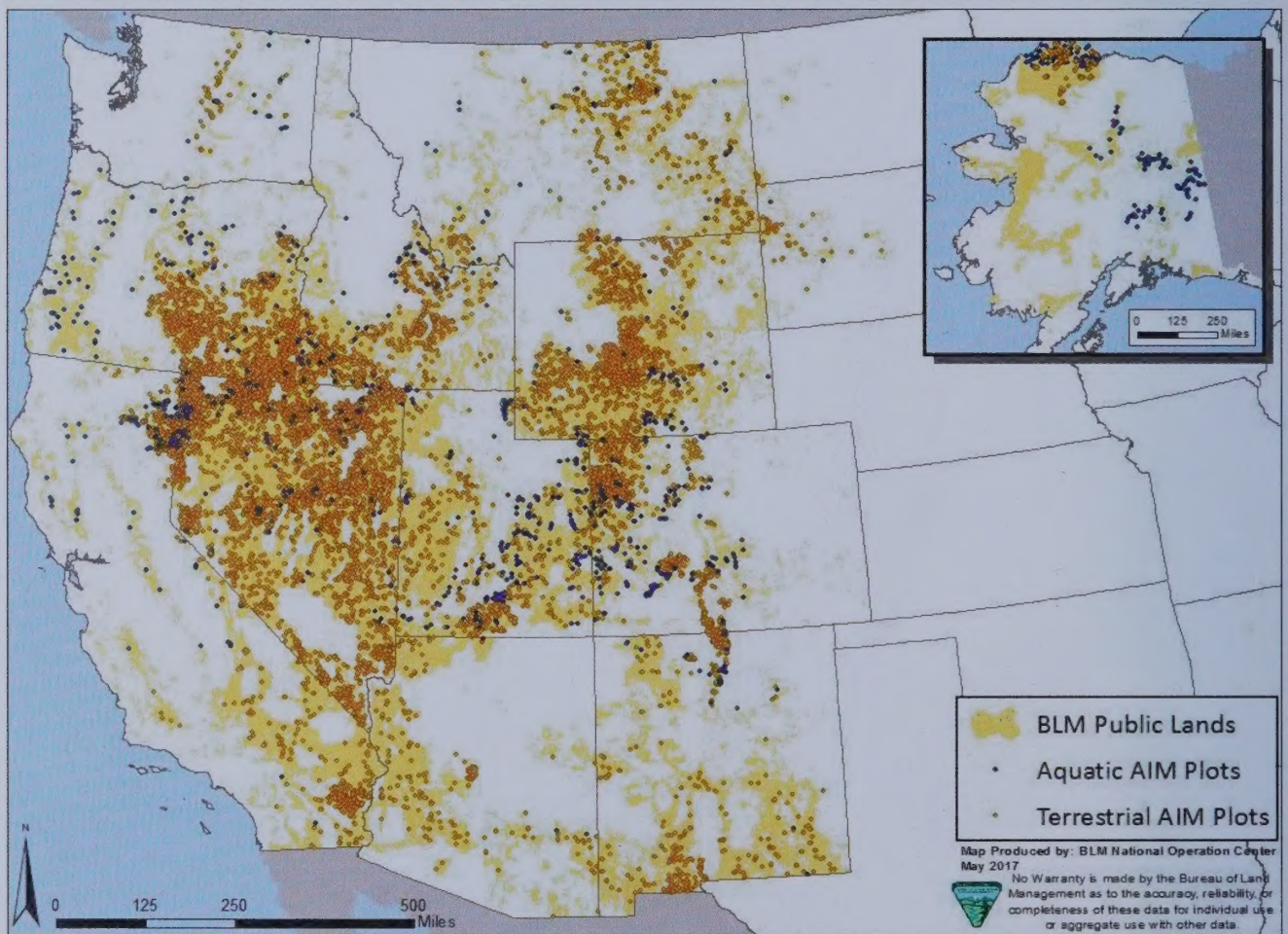
BLM's Assessment, Inventory, and Monitoring Strategy

The goal of the AIM strategy is to reach across programs, jurisdictions, stakeholders, and agencies to provide key information for decision makers that can be collected once and used many times.

AIM

BLM's Assessment, Inventory, and Monitoring Strategy

Assessment, Inventory, and Monitoring (AIM) Efforts



SPATIAL DISTRIBUTION OF TERRESTRIAL AND AQUATIC AIM POINTS SAMPLED THROUGH 2017

EXECUTIVE SUMMARY

Background (page 5)

The AIM strategy was designed to improve the effectiveness of monitoring activities on public lands and the defensibility of BLM management decisions. The Office of Management and Budget (OMB) identified the need for increased monitoring efficiency and effectiveness in a 2004 review that found BLM had “gaps in monitoring of resource conditions to support management decisions and to assess the impacts of restoration of activities” and that “a lack of understanding of resource condition was a weakness” (2004 PART assessment of BLM’s Restoration Programs; 2004 through 2008 passback language). This criticism highlighted that the Bureau’s historic approach to monitoring – designing individual studies to meet specific project and program objectives at the field level – was not adequate to meet our legal mandates. OMB directed the BLM to analyze its monitoring activities and allocated funds for the development of a more comprehensive, cost-effective, and consistent approach to monitoring. This resulted in development of the AIM strategy.

The AIM strategy’s effectiveness in addressing OMB’s criticisms is due to five foundational principles: 1) standard core indicators and methods, 2) statistically valid sampling designs, 3) a structured implementation process, 4) electronic data capture and management, and 5) integration with remote sensing. It is imperative that we adhere to these principles to protect our investment in collecting and using high quality, reusable, defensible monitoring data and to meet our statutory obligations and policy commitments.

Benefits (page 13)

AIM implementation has benefits for both resource conservation programs and resource use programs. It can help streamline NEPA and permitting, and improve confidence in and effectiveness of management decisions. Using the AIM strategy will provide industry with increased certainty and predictability, key elements for effective business planning. The AIM strategy also provides a framework for effective communication of industry successes based on verifiable and ecologically meaningful metrics. This can help industries improve brand reputation, foster positive community relationships, and gain essential social license to operate.

AIM is a framework through which BLM can improve the health and productivity of the land to support our multiple use mission and improve accountability to our stakeholders. AIM can help strategically target work activities to get the most value for taxpayer dollars. It can help establish objective reclamation standards so costs of maintaining healthy lands are not passed to taxpayers, and communities accrue the economic benefits of healthy lands along with those of resource production. AIM can help BLM improve local decision making and combine data with other agencies to provide a foundation for partnerships that extend the value of taxpayer dollars and help develop and implement shared conservation strategies. And, because AIM data is thoroughly documented, consistent, and statistically unbiased, it increases the likelihood of success in appeals and litigation.

Return on Investment – The Data Asset (page 18)

Support for offices to implement AIM has increased over the last decade, and implementation has spread to nearly every field office in the Bureau. We are just now at the point where BLM can fully realize return on investment with reports on resource condition and trend to support management decisions at multiple scales, on the effectiveness of our land use plans, and on the effectiveness of our treatments. The BLM is now able to succeed where OMB said we were failing in our mission. This section provides a state-by-state overview of AIM data collection status, snapshot examples of how that data answers management questions in a variety of field offices, and case summaries (page 54) of AIM applications to address management objectives.

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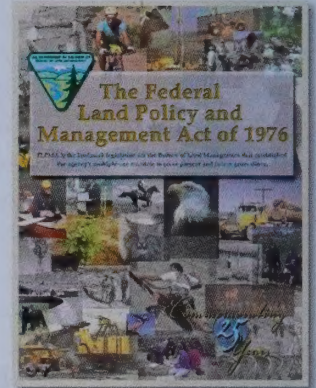
Background

"The rate of change and the amount of use on public lands are at unprecedented levels. Deriving the knowledge of how ecosystems are changing, which is essential to guide and justify management, use, or policy actions, necessitates consistent data that can serve many monitoring objectives and can be aggregated for use across multiple scales of management (from field to national levels). Given capacity constraints and the sheer number of monitoring needs, it is no longer possible to implement individual monitoring and assessment plans for each identified threat or use." - AIM-Monitoring: A Component of the BLM Assessment, Inventory, and Monitoring Strategy. BLM Technical Note 445

WHY WE HAVE THE AIM STRATEGY

Mission

Congress has charged the BLM with monitoring the condition of public lands in various laws, from The Taylor Grazing Act of 1934, through The Healthy Forests Restoration Act of 2003. In particular, the Federal Land Policy and Management Act of 1976 (FLPMA) requires that we prepare and maintain an inventory of all public lands and their resource and other values, and keep it current to reflect changes in conditions and to identify new and emerging resource and other values. The Public Rangelands Improvement Act of 1978 (PRIA) reiterates this mandate and requires that these inventories be available to the public.



Mission Failure and Directed Funding

In their 2004 PART assessment of BLM's restoration programs, the Office of Management and Budget (OMB) determined that BLM had "gaps in monitoring of resource conditions to support management decisions and to assess the impacts of restoration of activities." In 2005, OMB directed \$2M to develop an integrated monitoring strategy that would address these shortcomings. In subsequent years' budget language they repeatedly stated that "a lack of understanding of resource conditions was a weakness" for BLM (2004, 2005, 2007, 2008 Passbacks). In the 2007 passback OMB wrote "BLM has yet to present a clear plan for how it would conduct this monitoring. ... In particular, OMB is interested in land health data that can be 'rolled up' to the national level and in the amount and quality of information that is accessible to the public through BLM's website." In the 2008 Passback, OMB stated "A lack of understanding of resource conditions was a weakness identified in the 2004 part on BLM's restoration programs and again in this year's Resource Management PART." Our historic approach to monitoring - designing individual studies to meet specific project and program objectives at the field level - was not meeting our legal mandates for reporting on the condition of public lands.

Strategy Development

The BLM established an Interdisciplinary Core Team in 2005 that worked with partners, including USGS, USFS, NRCS, and ARS, to develop a vision for an Assessment, Inventory, and Monitoring (AIM) strategy. Importantly, the first step was to evaluate existing assessment processes, resource inventories, and monitoring procedures across the Bureau. We conducted pilot projects to test work processes that would move the Bureau toward integrated data collection, allow management of data as a corporate asset for multiple uses, and improve data accessibility at all organizational levels. These efforts led to the 2011 publication of *The Bureau of Land Management Assessment, Inventory, and Monitoring Strategy for Integrated Renewable Resources Management*, followed by *Core Terrestrial Indicators and Methods* (2011), *AIM Monitoring: A component of the AIM Strategy* (2014), the *AIM National Aquatic Monitoring Framework* (2015), and the *Field Protocol for Wadeable Lotic Systems* (2017).

Support and Endorsement

The peer-reviewed AIM strategy is compatible with strategies used by various partners, including NRCS, EPA, USGS, USFS, and state agencies. The National Academy of Sciences embraced it in their 2013 report *Using Science to Improve the BLM Wild Horse and Burro Program: A Way Forward*. OMB has directed \$8M per year to implement the AIM strategy. Reaffirming OMB's desire to understand the effectiveness of our Land Use Plans and the centrality of plan objectives to program effectiveness, they placed this funding under the Resource Management Planning budget rather than any resource-specific program.

Policy

Because AIM core indicators are based on indicators of land health (43 CFR §4180.1), AIM is ideally suited for monitoring achievement of land health standards. The BLM has developed policy stating that we will use land health standards as the basis for assessing the effectiveness of our programs, and will use AIM as the basis for assessing the effectiveness of management actions in meeting plan objectives. Key policy documents include:

BLM Manual 4180 – Land Health

- “The BLM will conduct land health evaluations and issue annual reports to communicate with the public and local, State, and tribal governments about land health.”
- “The BLM will report evaluations, findings, monitoring results, planned actions and progress toward meeting standards for individual evaluation areas.”
- “Action necessary to achieve, or make progress toward achieving, land health standards developed for each region will occur:
 - unless otherwise specified in the land use plan,
 - for all programs as prioritized and funded through the budget process”
- “Programs that authorize uses on public land will provide guidance and direction ... to ensure consistency between their programs and this manual section. Program managers will ensure that program best practices are applied to use authorizations, as needed, to help ensure that land health standards and related land use plan resource condition goals and objectives are achieved.”

BLM Handbook H-1601-1 – Land Use Planning Handbook

- “Effectiveness monitoring is the process of collecting data and information in order to determine whether or not desired outcomes (expressed as goals and objectives in the land use plan) are being met (or progress is being made toward meeting them) as the allowable uses and management actions are being implemented. A monitoring strategy must be developed as part of the land use plan that identifies indicators of change, acceptable thresholds, methodologies, protocols, and timeframes that will be used to evaluate and determine whether or not desired outcomes are being achieved.”

IM 2016-139 – Policy for Resource Management Plan Effectiveness Monitoring for Renewable Resources with Additional Guidance for Plans Implementing the Greater Sage-Grouse Conservation Strategy

- “Data to inform the effectiveness of the RMPs will be collected following the Assessment, Inventory and Monitoring (AIM) principles (BLM Technical Note 445) following a rotating panel design.”
- “In addition ... the GRSG Plans ... will use AIM data, methods, data capture, and data management to assess the status and trend of GRSG habitat within a region, state, or habitat management area as defined in the GRSG Plans.”

IM 2016-144 – Gunnison and Greater Sage-Grouse (including the Bi-State Distinct Population Segment) Habitat Assessment Policy

- “BLM FOs, DOs, and SOs will work with the assessment and monitoring branch at the NOC to design a sampling strategy that conforms to the national AIM sampling strategy and provides adequate sample points in sage-grouse seasonal habitats to complete the site-scale habitat assessment data collection.”
- “BLM offices in need of additional sampling locations to complete the habitat assessment process should use a statistically-valid sampling design that conforms to the AIM strategy. FOs should

coordinate with their state AIM coordinator or the NOC AIM leads to generate an appropriate sample design.”

- “Site-scale data: The FOs, DOs and/or SOs are responsible for site-scale data collection, quality assurance, and management. The NOC is responsible for consolidating and serving the site-scale habitat indicator data collected under the AIM core methodologies, as well as providing analytical support for these data.”
- “The core and supplemental indicator data collected as part of the AIM strategy should be used to inform the HAF site-scale indicators within sage-grouse habitats. If the field office has collected data following techniques other than the AIM technique (HAF, Table 14), begin transitioning to the AIM techniques for consistent measurements across the range.”

Sage-Grouse RMP Amendments, Appendix D – The Greater Sage-Grouse Habitat Management Strategy

- “In order for this data to be consistent and comparable, common indicators, consistent methods, and an unbiased sampling framework will be implemented following the principles in the BLM’s AIM strategy This information will be used to answer Question 1 of the Land Use Plan Effectiveness Report.”

Approved Resource Management Plan Amendments/Record of Decision (ROD) for Solar Energy Development in Six Southwestern States

- “The BLM has committed to developing and incorporating a larger monitoring and adaptive management strategy into its Solar Energy Program This long-term solar monitoring and adaptive management plan will be based on BLM’s Assessment, Inventory and Monitoring (AIM) Strategy developed in 2011.”

“Historically, grazing, has been a dominant land use on rangelands worldwide. In the United States, though, it is increasingly a minor component in some rangelands compared to other uses such as energy development, recreation, and conservation. Diffuse and widespread disturbances that alter the character and potential of rangelands like non-native plant invasion, woody plant encroachment, and altered wildland fire regimes are prevalent. Additionally, rangelands are increasingly being valued for providing ecosystem services including clean and reliable water supplies, clean air, recreational opportunities, and habitat for many plants and animals These changes have altered the need for and character of rangeland monitoring.” – “Monitoring Protocols: Options, Approaches, Implementation, Benefits,” Jason W. Karl, Jeffrey E. Herrick, and David A. Pyke in D.D. Briske (ed.), *Rangeland Systems*, Springer Series on Environmental Management, 2017

WHAT MAKES AIM EFFECTIVE?

The ability of AIM to address the criticisms that OMB levied is due to a foundation of five essential principles:

Standard core indicators and methods

Standardized measurements allow comparison of data collected at different times and locations, and allow reuse of data for many different purposes. Core terrestrial and aquatic indicators were selected because they are known to be both ecologically relevant and clearly tied to standards for land health and clean water at state and federal levels. It is important to note that not only the indicators are standardized, but also the methods used to collect the data, the training, and the data capture and storage. This means that the same data are collected in the same way at each sampled site. This helps ensure that AIM data are comparable across boundaries, across programs and jurisdictions, and through time.

Statistically valid sampling designs

The heart of an AIM project is a statistically valid sample design. In practice, this means that within a landscape of interest, data is collected at predetermined locations that were randomly identified during the design stage. Sampling in this manner makes the data applicable to the entire landscape of interest so we can report on the condition and trend within an area of interest with known levels of precision and accuracy. Targeted sites to address management questions at specific locations can be included along with the randomized sample. However, targeted sampling alone cannot provide valid estimates of resource condition and trend beyond the sampled site. One of OMB's findings was that we did not collect data in a manner that allowed us to describe the condition of public lands. A statistically valid design addresses this criticism, as well as our mandates in the Taylor Grazing Act, FLPMA, and PRIA.

A structured implementation process

AIM follows a structured implementation framework. Each effort begins by working with an interdisciplinary team to identify monitoring objectives, available background information, key ecosystem processes, critical management questions, and regulatory requirements. Monitoring objectives, indicators, and activities are planned and implemented on a 5-year rotating panel. This helps avoid informing decisions with one-time snapshots, and informs an iterative process of adaptive management. Sound data management, including detailed records, quality assurance/quality control, and storing data in a national geospatial infrastructure, are key components of this framework, as is systematic training to ensure consistency. This provides a data set that is thoroughly documented, comparable from project to project, and defensible when challenged.

Electronic data capture and management

Electronic data capture at the time of sampling maximizes data collection efficiency, avoids lengthy manual data entry tasks, and ensures data quality. Enterprise data storage and management ensures data security and facilitates reliable data access and use at all levels of the Bureau. AIM data are at the fingertips of BLM staff agency-wide for application to a variety of management objectives.

Integration with remote sensing

Remotely sensed data provide a bird's eye view of conditions across the landscape. These data compliment field data by providing the location, amount, and spatial pattern of resources and the status, condition, and trend of these resource attributes across broad geographic extents. Field data are essential for creating and verifying remotely sensed data, and remotely sensed data can be used to provide context or prioritize areas for field data collection.

THE IMPORTANCE OF STRUCTURE IN AIM STRATEGY IMPLEMENTATION

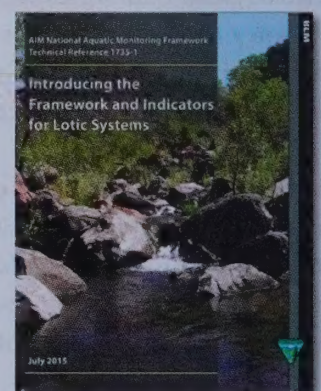
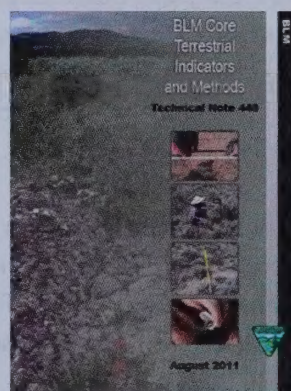
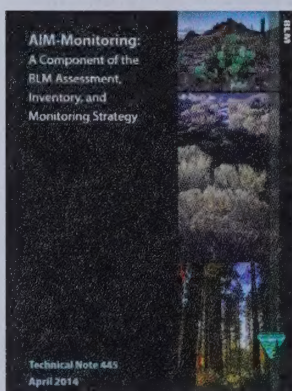
Principles Matter

AIM is effective because of the core principles on which the strategy is built. While the AIM core methods and indicators could be applied to our traditional monitoring approach of designing individual studies to meet specific project and program objectives at the field level, the benefits of AIM cannot be realized by sampling primarily targeted sites. Similarly, using a statistically valid sampling design but only collecting a sub-set of core indicators or using varying collection methods will not yield scalable data that address multiple resource questions or that can be combined with that from partner agencies. Also, while we could replace AIM training with just written materials, it has been shown that the most difficult crew calibrations are with seasoned data collectors; without stringency in training, crew calibration, and data management, we drift away from the consistency that makes AIM data reusable and defensible.

Examples of procedures and practices that enforce the foundation principles of AIM include:

- Requiring that all AIM monitoring efforts include, at a minimum, the full suite of core indicators, collected using AIM core methods;
- Requiring that all AIM monitoring efforts develop and follow a statistically valid sample design with assistance from AIM core cadre;
- Requiring that all AIM crews attend standardized training at least once every 3 years, and perform regular crew calibrations;
- Subjecting all data to strict QA/QC procedures and rejecting data that do not meet quality standards.

Such stringency in standardized procedures and practices is a departure from BLM's traditional approach to monitoring and assessment based on local preferences and short-term objectives. AIM implementation is designed to minimize field office impacts during field season by funding seasonal crews, with sample design and data analysis occurring in the off seasons. Still, the strong emphasis on standardization and structure can seem excessive and misdirected from the perspective of offices with limited resources, high volume workloads, and pressure to make immediate decisions. However, relaxing the foundation principles of AIM means losing the ability to effectively address the deficiencies identified by the OMB, to meet our statutory obligations and policy commitments, and to protect the significant investment that the BLM has already made in collecting high quality data. Understanding the value of AIM principles requires an awareness of mission aspects beyond the local office or program level, and adoption of a new way of thinking about monitoring in the BLM. In order to gain greater acceptance of this change, it is critical to foster strong management support and a positive and thorough understanding throughout the Bureau of the importance of decisions informed by scalable, structured, defensible data.

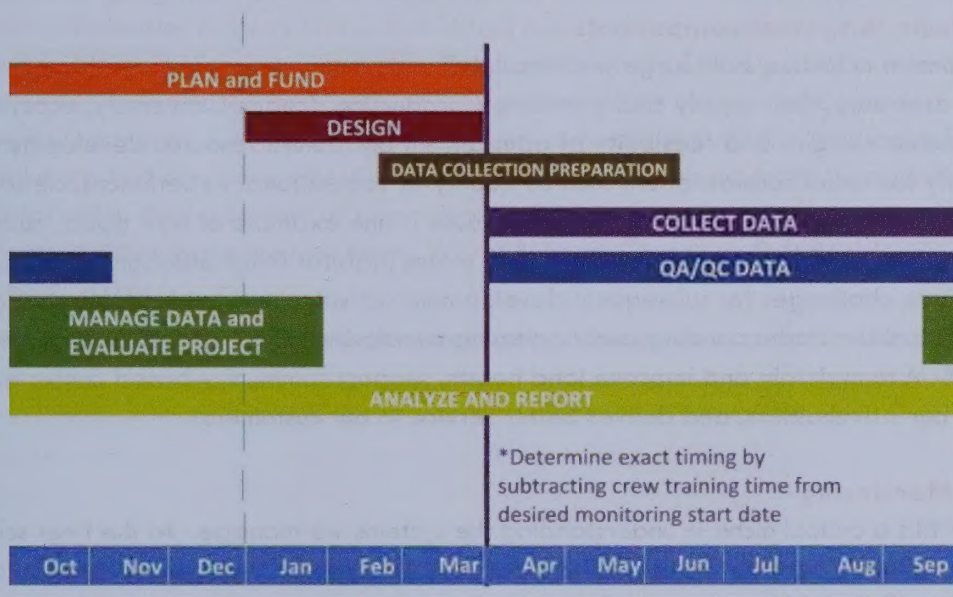


PROCESS: HOW AIM IMPLEMENTATION WORKS

The AIM strategy is much more than field data collection. It is a structured framework that begins with project planning and initiation, project design and detailed preparation for field data collection. Data collection is conducted according to the project design. Structured data management and project evaluation ensure the data are securely stored in corporate databases to protect the investment. Quality assurance and quality control (QA/QC) procedures underlie all of these steps, including structured training in data collection and management for field crews. Analysis and Reporting are ongoing processes conducted by the National Operations Center (NOC) and National Aquatic Monitoring Center (NAMC) staff in collaboration with field staff to turn the data into useful information and reports that inform local, regional, and national decisions.

Field and state offices have support at every step of the process. Staff from the NOC and NAMC provide direct field support for project planning and implementation, training, data management, analysis, reporting, and remote sensing, while specialists from NAMC and the Agricultural Research Service's Jornada Research Range provide project design and science support.

Yearly AIM Implementation Calendar



A SYSTEMS VIEW OF BLM'S MISSION

“... industrial or commercial land-uses (e.g. agriculture, forestry, mining or energy), human settlements and ecosystems are not isolated or self-contained units but part of a wider landscape in which different land uses (and users) rely on the same natural resources and functions for their activities. They are thereby interdependent and affect each other.” – *Sustainability beyond fence-lines: Why landscape approaches make business sense*, World Business Council on Sustainable Development, 2016

When we know better, we do better.

Managing public lands and resources in the 21st century requires acknowledging that we manage complex systems in which ecological, social, and economic components interact at multiple scales. Regardless of whether we focus on habitat quality and access for sporting enthusiasts, vegetative productivity for range capacity and forest products, soil stability for dust control, or water quality and quantity for community drinking water, regional conditions are a function of local conditions, and local conditions are a function of regional conditions. The AIM strategy is a key tool in the toolbox for understanding conditions and trends across multiple scales and making informed decisions to manage healthy, productive lands that support the BLM's multiple use mission.

Cumulative effects to system components

Resource development activities, both large and small, influence ecosystem processes through the footprint of facilities and infrastructure, their supply chain, and their production stream. Conversely, ecosystem processes influence the economic margins and feasibility of both current and future resource development. Similar relationships apply for social considerations such as quality of recreational experiences, clean water availability, and other ecosystem services. The sage-grouse is one example of how good-faith local analyses can fail to account for cumulative impacts at the broad scales (habitat fragmentation), resulting in undesirable ecological conditions, challenges for subsequent development activities and land uses, and degradation of recreational opportunities. Understanding and monitoring cumulative effects on resource condition and trend is essential for the BLM to maintain and improve land health, support community-based conservation, improve accountability to our stakeholders, and deliver better service to our customers.

Multiple Scale Monitoring

The AIM strategy fills a critical niche in understanding the systems we manage. At the finer scale, local assessment and monitoring activities have a role to address site-specific issues and evaluate causal factors where AIM monitoring identifies departures from desired conditions. At the other end of the spectrum, BLM is working with partners to develop disturbance tracking tools and broad-scale indicators of resource condition that will help complete the picture. Together these will provide a holistic, multi-scale view of the systems we manage and help manage public lands for multiple use and sustained yield to meet the ecological, social, and economic needs of present and future generations.

Benefits

“Mining and oil & gas companies require access to a finite set of raw materials that are found in predetermined locations based on geological formations. Companies are thus bound to invest in specific geographies to sustain and grow operations. This location-specific nature of the extractive industries is a key factor that drives innovative approaches to mitigating risks posed by operating in locations where there are sensitive habitats, vulnerabilities to the supply of water, or instability among neighboring communities because of degraded environmental resources. ... Framing and managing such risks through the landscape lens can present solutions that are more effective, feasible and economically viable than solutions restricted to ‘within the fence-line’ of operations.” (*Sustainability beyond fence-lines: Why landscape approaches make business sense*, World Business Council on Sustainable Development, 2016)

IMPROVING ACCOUNTABILITY TO OUR STAKEHOLDERS AND DELIVERING BETTER CUSTOMER SERVICE

Streamlined permitting and NEPA

Once established for a region, the AIM strategy can provide a robust, reusable framework and terminology to standardize 1) description of the affected environment, 2) analysis and mitigation of direct, indirect, and cumulative impacts at multiple scales, and 3) establishment of reclamation objectives and success criteria. AIM data can also help identify where resource conflicts are less likely to occur. Together, this can simplify the task of determining whether a development and reclamation plan will avoid undue and unnecessary degradation of public lands, resulting in reusable analyses and streamlined authorization processes that get permits out the door faster.

Improved confidence in and effectiveness of management decisions

In addition to streamlining authorization processes, a decision framework based on the AIM strategy results in improved consistency among decisions and improved confidence that the decisions will achieve desired resource conditions. Local managers have a reliable, repeatable framework and metric that allows them to make lands, mineral resources, and energy corridors available for development in an environmentally-sound manner. At the same time, they can confidently demonstrate how their decisions are meeting RMP objectives, achieving land health standards, and avoiding undue and unnecessary degradation of public lands.

Increased certainty and predictability for industry

Consistency and predictability are essential for sound business planning. The AIM strategy has powerful potential as a framework for establishing reclamation objectives and success criteria that industry can rely on from operation to operation, field office to field office, state to state. By providing an appropriate ecological context based on site potential and actual range of environmental variability, it can eliminate perceptions of unrealistic reclamation expectations and perceptions that different operators are held to different standards. It can allow operators and/or contractors to have trained crews that can assess reclamation at many different types of operations, across multiple field offices, using the same data and methods that BLM uses. Reclamation standards and evaluation metrics on public lands can be a known quantity, allowing industry to make more informed business decisions.

Building community relationships and gaining social license to operate

The AIM strategy provides a consistent framework to highlight and demonstrate successful reclamation at multiple scales using measurable, ecologically meaningful terms. This can help industries improve brand reputation by fostering positive relationships with local communities, environmental organizations, and other stakeholders. It has also been shown that companies benefit from improved employee motivation and retention due to positive perception of company behavior, particularly amongst millennials (*World Business Council for Sustainable Development, 2017*). While major corporations like Newmont Mining have embraced the value of gaining and maintaining such “social license to operate,” the AIM strategy can establish a framework for communicating successes that will help responsible operators of all sizes foster positive community relationships, establish credibility, and gain public trust.

“You don’t get your social license by going to a government ministry and making an application or simply paying a fee... It requires far more than money to truly become part of the communities in which you operate.” - Pierre Lassonde, President of Newmont Mining Corporation.

IMPROVING THE HEALTH AND PRODUCTIVITY OF PUBLIC LANDS

A context for community-based conservation

AIM provides a quantitative landscape context in which to interpret the conditions observed at any given site, and a quantitative basis for establishing ecologically appropriate desired resource conditions. By capturing the range of conditions and trends across the landscape, it can provide a baseline for site capability and a basis for comparison of resource conditions on public lands with those on state and private lands. This can help provide context for community-based conservation efforts and develop partnerships to achieve shared conservation strategies across jurisdictions.

Appropriate and achievable land health standards

AIM monitoring results can help establish reclamation and restoration objectives that restore functional ecological conditions, and target treatment and restoration projects to where they have the highest value and highest probability of success. With the ability to establish measurable objectives for land treatments, reclamation, and mitigation of environmental impacts, resource programs can demonstrate that benchmarks they establish are both ecologically appropriate and achievable based on site capability and the demonstrated range of landscape variability. Consistently ensuring effectiveness of treatments, reclamation, and mitigation allows the BLM to get the most value for public dollars and maintain the health and productivity of public lands to support the BLM's multiple use mission.

Targeted development

AIM monitoring can help identify areas with higher probability of reclamation success and/or lower vulnerability to habitat degradation. This allows resource specialists and managers to direct development activities to less sensitive locations. This, in turn, will facilitate more effective reclamation results while reducing the complexity of environmental analyses, streamlining permitting processes, and helping operators avoid the costs of more complex mitigation or reclamation that would be needed at more sensitive locations.

Awareness of cumulative resource conditions

AIM monitoring can help resource specialists maintain awareness of conditions across the landscape. This can serve as a basis for improved analysis of cumulative effects. It also facilitates earlier identification of areas at risk of habitat fragmentation or degradation and helps monitor the intactness of important habitat features like connectivity corridors. By avoiding unforeseen large-scale cumulative impacts (such as sage-grouse habitat fragmentation), BLM can be more accountable to our stakeholders and better able to ensure the health and productivity of public lands.

Program Integration and Standardization

Collecting resource information such as vegetative cover and composition by different methods, at different times, for different purposes, is inefficient. AIM core indicators capture information collected by multiple programs, including range, riparian, soil/water/air, wildlife, fisheries, and NLCS, as well as minerals, lands and realty, and grazing. AIM data can be collected once and reused many times, avoiding duplicative inventory and monitoring efforts that may not be compatible from project to project or program to program. In addition to reducing BLM's overall costs to monitor public lands, this helps standardize information in order to determine attainment of resource objectives in a comparable and communicable manner between programs and across all public lands.

TAXPAYER VALUE, WORKING FAMILIES, AND SUSTAINABLE COMMUNITIES

Getting the most bang for the taxpayers' buck

Monitoring following the AIM strategy can help identify areas where resource conditions are not meeting plan objectives or land health standards, or are outliers relative to the range of variability within a region. This allows BLM to direct limited resources to where they are needed most and identify high-value resources that may need extra attention. Undertakings such as targeted assessments to evaluate causal factors, treatments for restoration and rehabilitation, or fuels reduction treatments, as well as special designations, can be placed where they will produce the most return for public funds.

Fair Market Value

FLPMA mandates that we obtain fair market value for the use of public lands and resources. While cost recovery procedures address direct and administrative costs, they do not address externalized costs of ensuring land health. Those direct and administrative costs can be dwarfed by the taxpayer cost to restore failed reclamation or mitigate widespread habitat fragmentation. AIM can provide a basis for quantifying resource conditions in a fair manner while ensuring that the costs of reclamation, restoration, or mitigation are treated as a cost of doing business rather than passed on to the taxpayers.

Working Families and Youth

BLM and our contractors employ and train several hundred of seasonals, interns, and technicians each year for AIM implementation (about 360 in 2017). These are mostly people beginning their careers, often youth, and frequently from local communities. Many start as contractors or seasonals then move into BLM term or career seasonal positions in subsequent years. This provides an entry-level pathway into agencies and industry that can grow into a career in natural resources management.

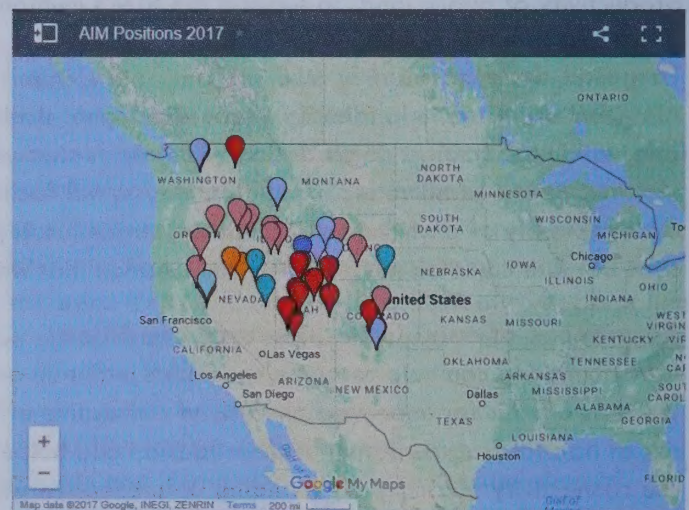
Well-rounded community economies

Maintaining land health while providing for resource use and production is good for communities. Some studies have estimated that the benefits of property value increase, water supply, flood prevention, pollution reduction, and recreation accrue values between \$153,000 and \$190,000 per acre for local communities (USDA, 1999). By using AIM to assess ecologically appropriate conditions for land health and establishing commensurate reclamation standards to which resource developments are held, BLM can help support healthy communities and sustainable community economies while providing for resource use and production on public lands.

Defensible decisions

Because AIM data is thoroughly documented, consistent, and statistically unbiased, it increases the likelihood of success in appeals and has potential to reduce the occurrence of expensive litigation.

JOB BOARD



Partnerships

The scalability of AIM data and the ability to combine data with other agencies provides a foundation for partnerships that extend the value of taxpayer dollars and help develop and implement shared conservation strategies. AIM data has helped form or inform partnerships with other Federal agencies, State agencies, universities, non-governmental organizations, and private industry. Various state government agencies such as the Nevada Department of Wildlife, Wyoming Game and Fish, and the Alaska Department of Environmental Conservation are engaged in data collection that is compatible with AIM and have expressed interest in cooperative efforts to understand landscape condition and trend.

Who uses AIM data?				
FEDERAL AGENCIES	STATE AGENCIES	UNIVERSITIES	NGOs	PRIVATE INDUSTRY
Agricultural Research Service	Alaska Department of Environmental Conservation	Colorado State University	Heritage Programs	ABR, Inc. – Environmental Research and Services
Argonne National Laboratory	Nevada Department of Wildlife	Oregon State University	NatureServe	Lithium Nevada Corp.
U.S. Environmental Protection Agency	Nevada Sagebrush Ecosystem Technical Team	University of Colorado, Boulder	Xerces Society	
US Fish and Wildlife Service	Wyoming Game and Fish	University of Idaho		
U.S. Forest Service		University of Massachusetts		
U.S. Geological Survey		University of Nevada, Reno		
National Aeronautics and Space Administration (NASA)		Utah State University		
		Yale School of Forestry and Environmental Studies		

Return on Investment

“It can be a tough slog getting an organization to the point where it has a leveragable data asset. In many organizations data lies dormant, spread across inconsistent formats and incompatible systems, unable to be turned into anything of value. Many firms have been shocked at the amount of work and complexity required to pull together an infrastructure that empowers its managers. But not only can this be done, it must be done. Firms that are basing decisions on hunches aren’t managing, they’re gambling.” - *The Data Asset: Databases, Business Intelligence, and Competitive Advantage*, John M. Gallaugh, Ph.D., 2009

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AIM: THE DATA ASSET

While it took time to get the components and infrastructure of the AIM strategy in place and functioning, AIM has reached the point where we can start fully realizing a return on investment. AIM has been implemented in nearly every field office in the Bureau. Data have been collected in 14 western states, in over 100 field offices, at 14,000+ terrestrial points and 1,000+ aquatic points. The data are housed and managed in national databases and are accessible for use by employees throughout the Bureau. Staff at the National Operations Center and the National Aquatic Monitoring Center are available to assist field offices with analysis and reporting to help support and inform management decisions at local, regional, and national levels. We are now able to succeed where OMB said we were failing in our mission.

This section provides a state by state overview of AIM data collection status, snapshot examples of how that data answers management questions in those states, and case summaries of AIM applications to address management objectives.

Accessing AIM Data Instruction Manual

Connecting to AIM Data:
TerrADot: Terrestrial AIM Database
LMP: Landscape Monitoring Framework Database

Created by: BLM National Operations Center
 Version 1.2 August 2016



BLM's Terrestrial Assessment, Inventory, and Monitoring (AIM) 2017 Field Season

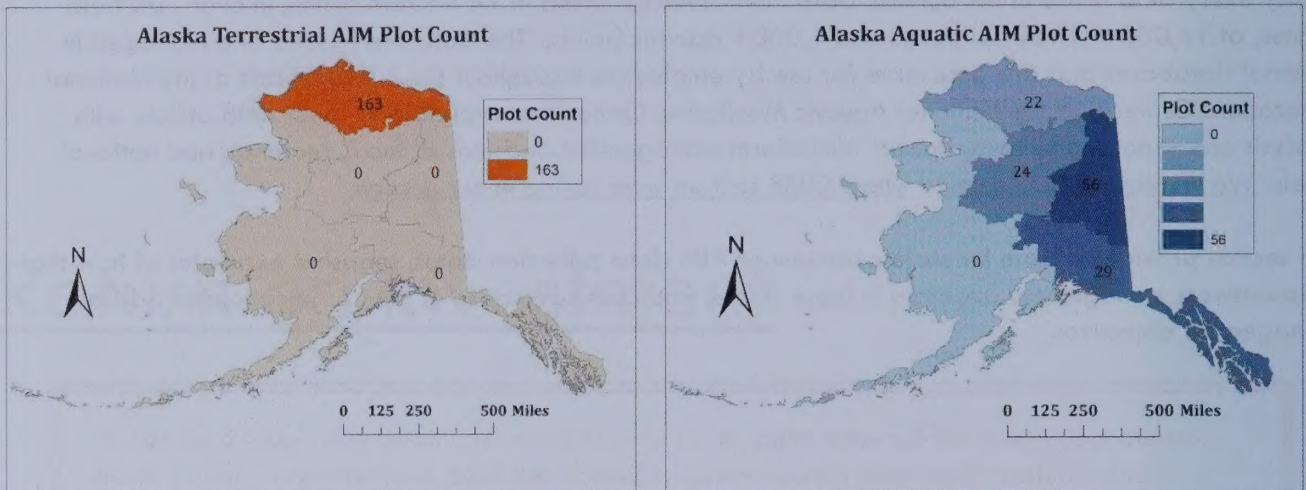
Data Management Protocol

VERSION 2.0

Produced by BLM National Operations Center and ARS-USDA Jornada Experimental
 Range - 02/2017

ALASKA: USING AIM TO IMPROVE RECLAMATION EFFECTIVENESS AND ESTABLISH BASELINE CONDITIONS

AIM DATA AVAILABLE NOW

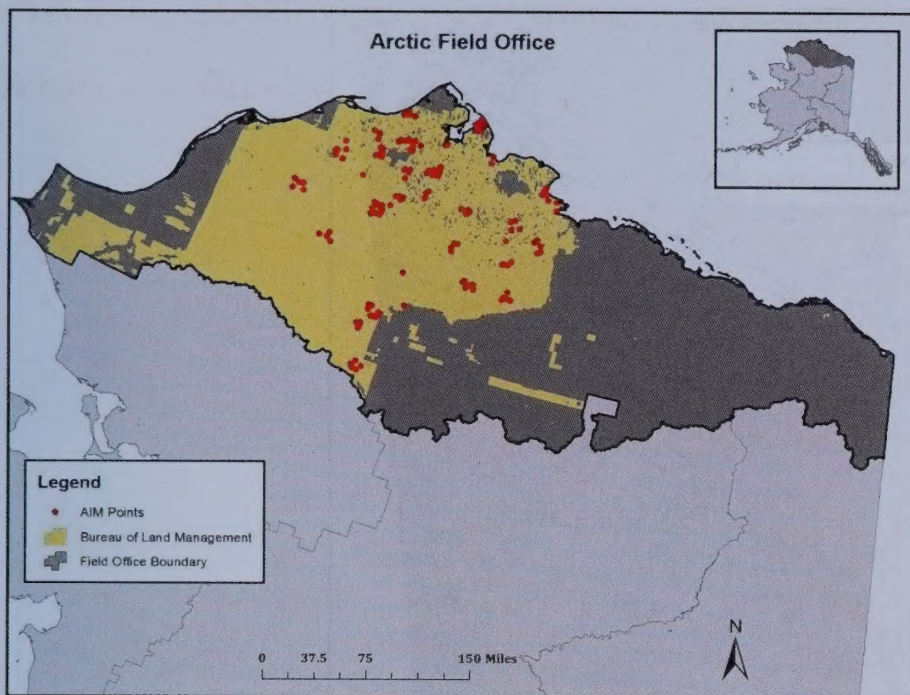


ALASKA AIM SUMMARY: National Petroleum Reserve of Alaska

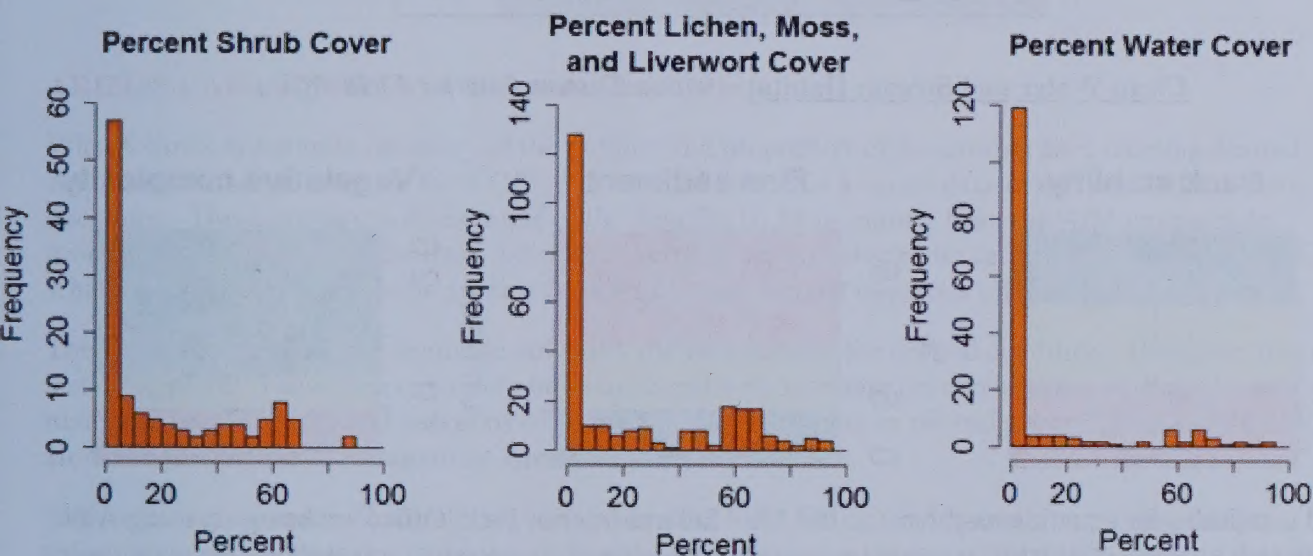
What follows is a simple summary of the distributions of key indicators within the National Petroleum Reserve of Alaska (NPR-A) for terrestrial AIM and the Eastern Interior Field Office for aquatic AIM. This information can be used by BLM staff to set desired conditions for this remote landscape. Desired conditions can be used to assess trends through time or the effectiveness of reclamation efforts, for example. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

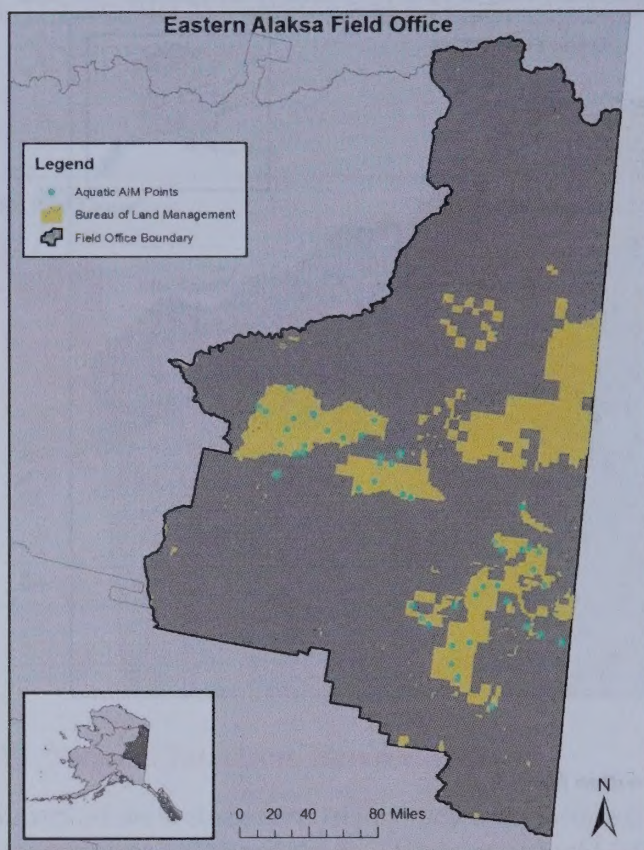
This summary includes all monitoring sites within the NPR-A or Eastern Interior Field Office, excluding post-fire treatment effectiveness or reclamation effectiveness sites. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



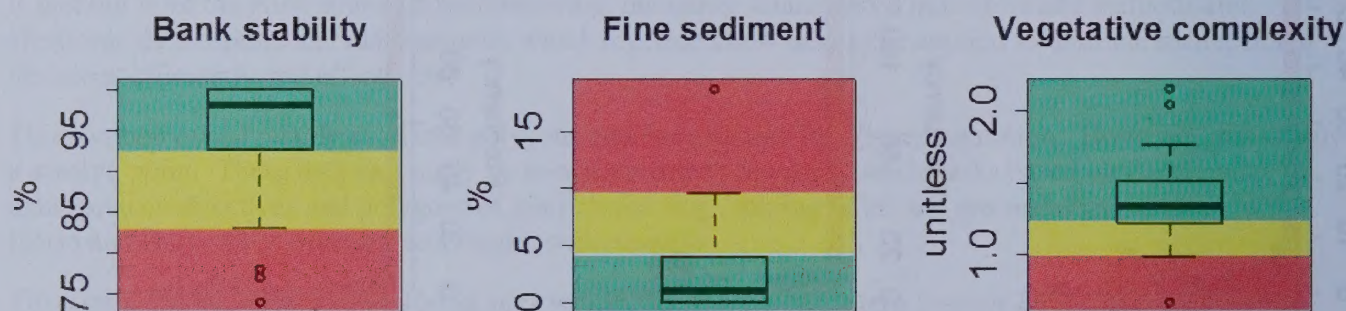
Arctic Habitat Conditions – within NPR-A



Desired conditions for terrestrial ecosystems in NPR-A have not yet been identified because baseline conditions were lacking. These frequency distributions show the number of plots that have particular values for three indicators of wildlife habitat condition and ongoing changes in Arctic ecosystems: shrubs, non-vascular plants (lichens, moss, and liverwort), and water. This information can be used by BLM staff to set desired conditions for the NPR-A.



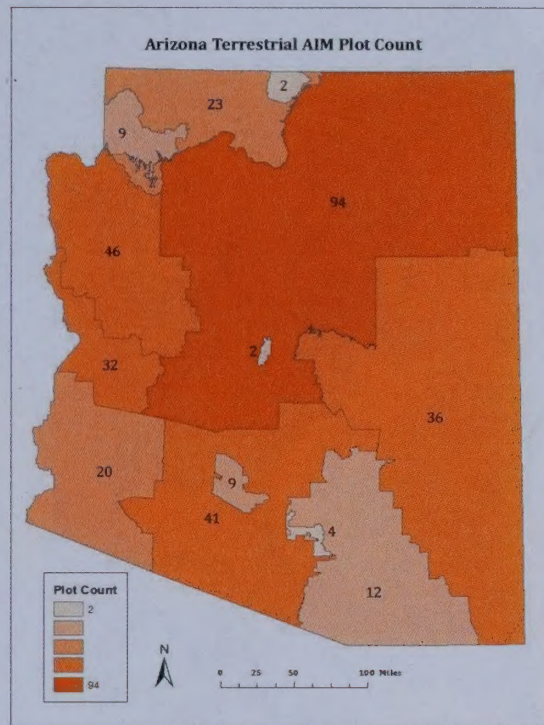
Clean Water and Stream Habitat – within Eastern Interior Field Office



Desired conditions for aquatic ecosystems in the AK - Eastern Interior Field Office are being set using AIM data collected as part of RMP effectiveness monitoring. Specifically, probabilistic sample points are screened to ensure the absence of anthropogenic impacts. The range of variability among reference sites (i.e., quantiles) is then used to establish desired conditions as shown in the above boxplots where: green = minimal departure; yellow = moderate departure; and red = major departure from reference. Such empirically derived desired conditions can be used to set RMP objectives, assess the effectiveness of reclamation efforts, or to assess trend, for example.

ARIZONA: GEARING UP FOR AIM

AIM DATA AVAILABLE NOW

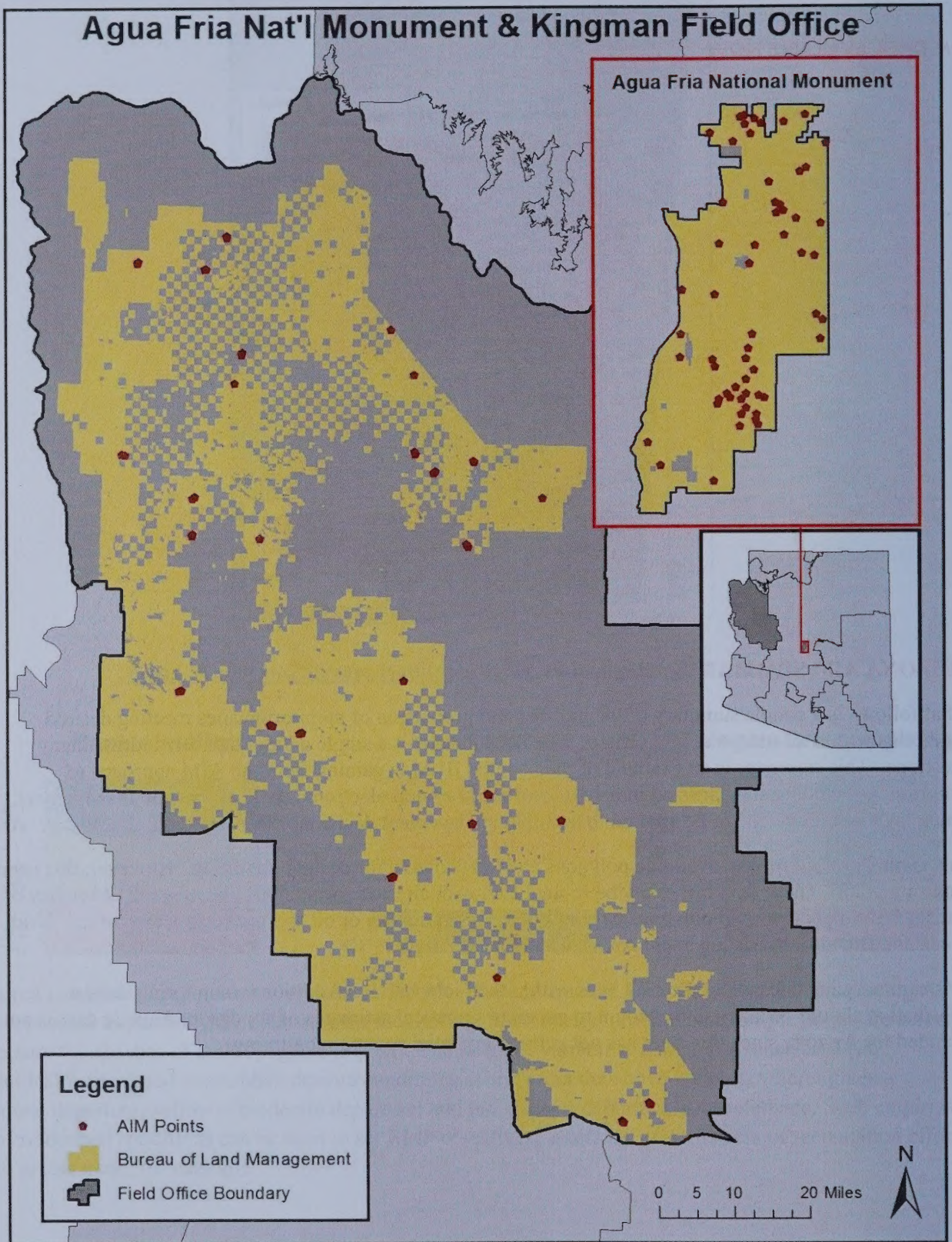


ARIZONA AIM SUMMARY: Kingman Field Office

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within an Arizona Field Office. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Office. Additional monitoring design information should be taken into account to generate statistical estimates of condition. Aquatic data is not included for Arizona since this state has not yet implemented aquatic monitoring.



Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Red Brome	40/46	87%

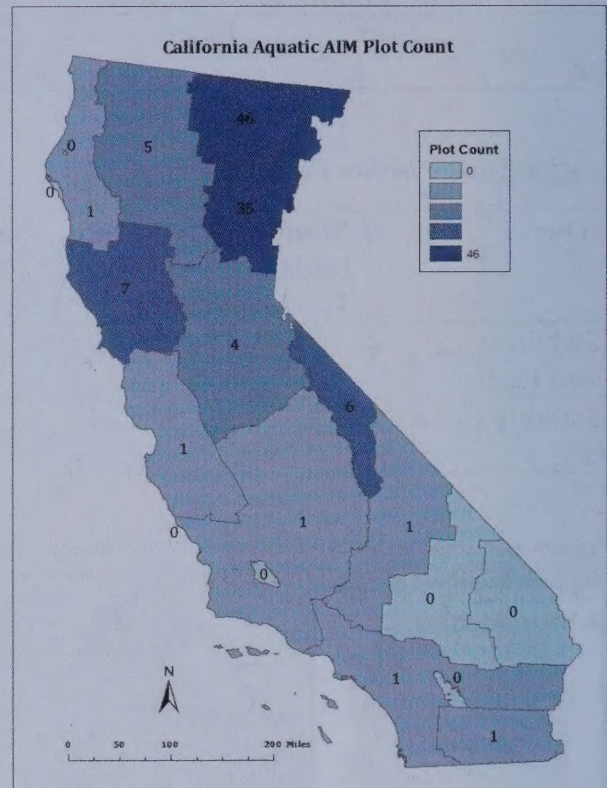
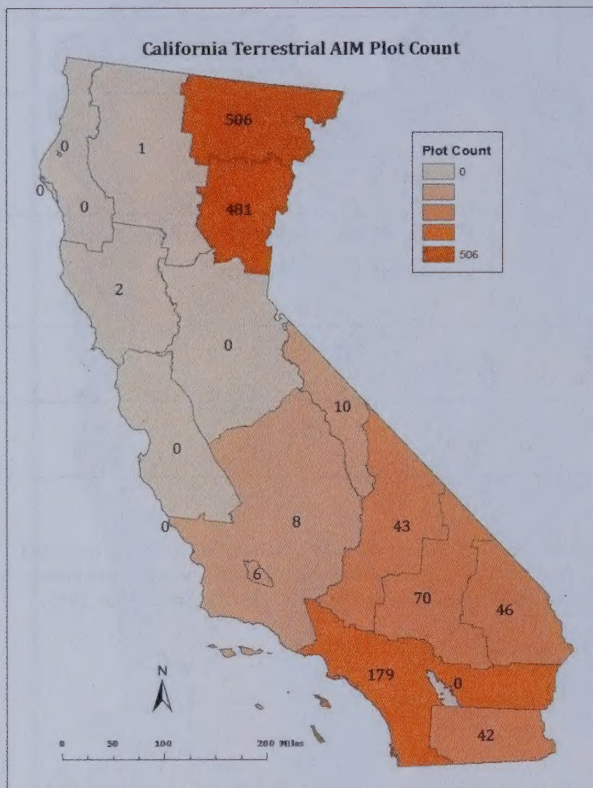
Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil Stability Between Plants	26/46	57%
Soil Stability Under Plants	18/28	64%

*Desired conditions for terrestrial indicators were set using the following: 1. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 2. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

CALIFORNIA: AN EARLY PILOT STATE

AIM DATA AVAILABLE NOW

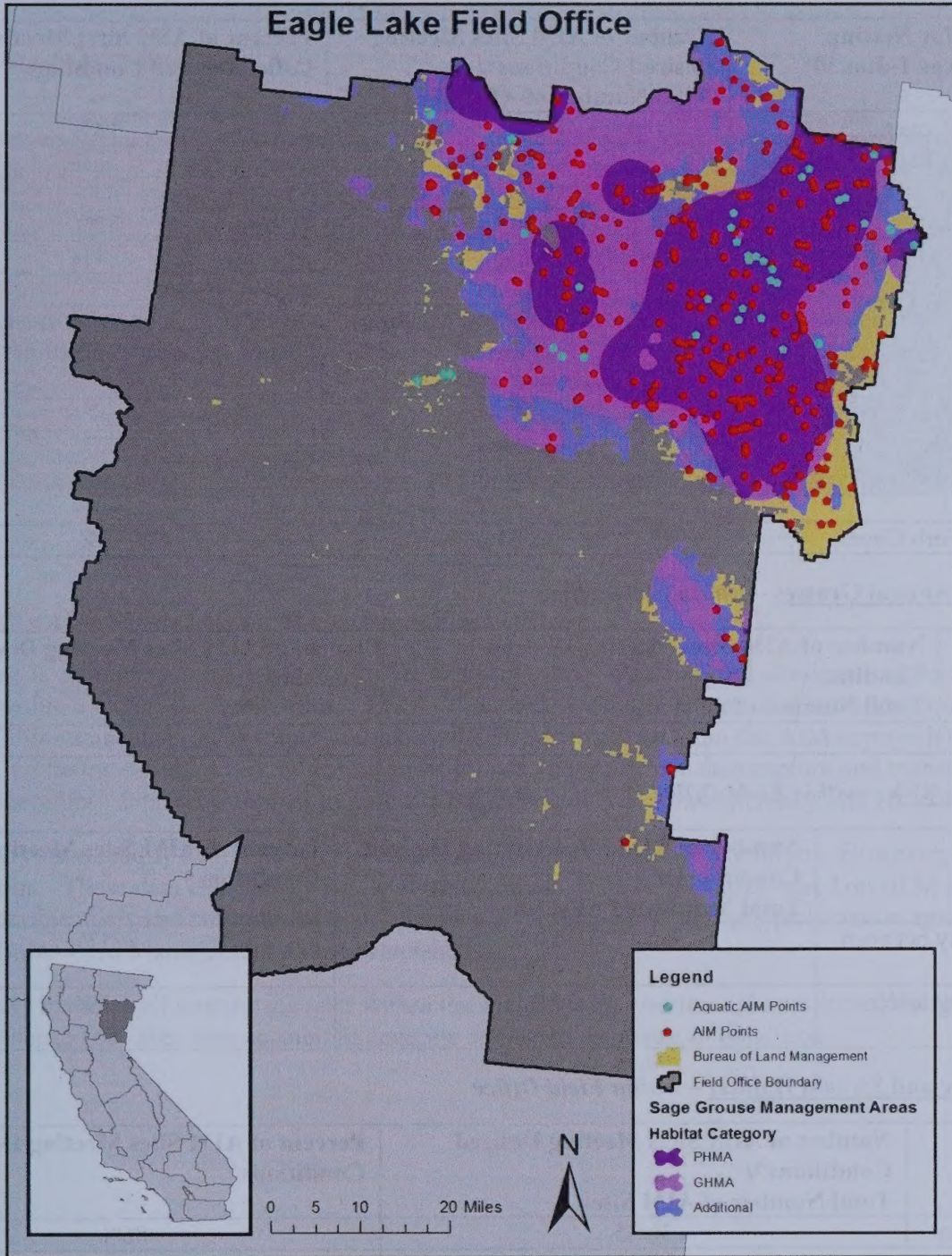


CALIFORNIA AIM SUMMARY: Eagle Lake Field Office

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within a California Field Office. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Office, excluding post-fire treatment effectiveness sites. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



Sage Grouse Habitat Conditions – Sage-Grouse Habitat within Field Office

Indicator for Nesting Habitat (Apr 1-Jun 30)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	16/111	14%
Sagebrush Height	41/111	36%
Perennial Grass Cover	52/111	47%
Herbaceous Plant Height	91/111	82%
Perennial Forb Cover	27/111	24%

Indicator for Brooding Habitat (May 15-Sept 15)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	118/345	34%
Sagebrush Height	92/345	27%
Perennial Grass and Forb Cover	177/345	51%
Perennial Forb Cover	31/345	9%

Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	173/481	36%

Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	75/353	21%
Soil stability under plants	88/353	25%

Clean Water and Stream Habitat – within Field Office

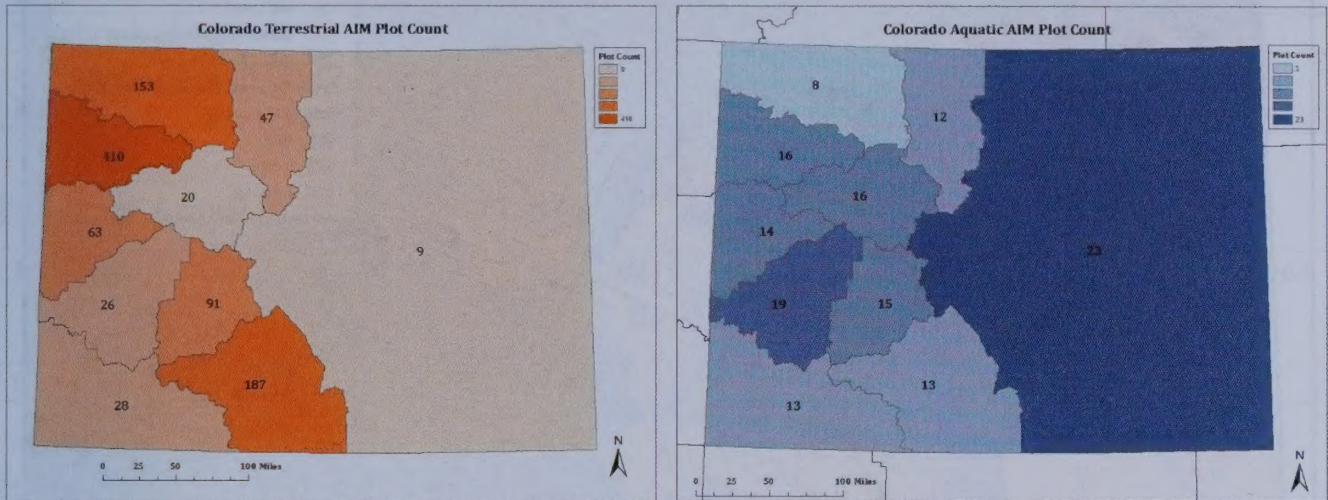
Indicator	Number of AIM Sites Meeting Desired Conditions^/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions^
Conductivity	30/35	86%
Fine Sediment	22/35	63%
Bank Stability	30/35	86%

*Desired conditions for terrestrial indicators were set using the following: 1. local **Resource Management Plan Amendment** for Greater Sage-Grouse and **Greater Sage-Grouse Habitat Assessment Framework** (Stiver et al. 2015); 2. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 3. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

^Desired conditions for water quality and stream habitat indicators were set using the following: 1. **modeling site-specific predictions** of the conductivity concentration that should naturally occur at a site (Olson and Hawkins, 2012); 2. the range of variability among networks of minimally impacted EPA and USGS **reference sites** by ecoregion for fine sediment (Stoddard et al. 2005); and 3. **professional judgment** and review of existing field office **policy** set bank stability benchmarks at 70 and 80% for arid and mesic regions, respectively.

COLORADO: EXPANDING AIM STATEWIDE

AIM DATA AVAILABLE NOW

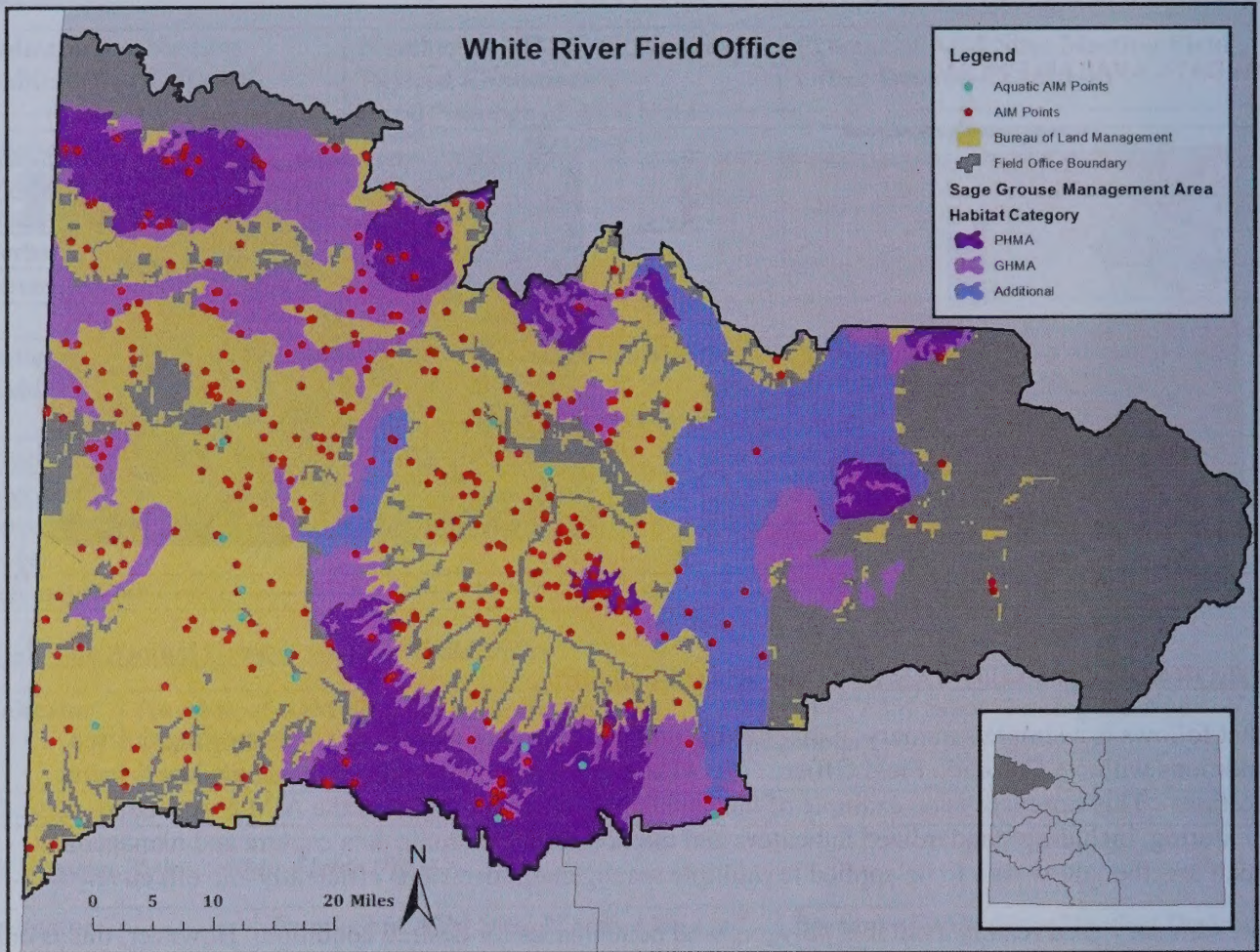


COLORADO AIM SUMMARY: White River Field Office

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within a Colorado Field Office. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Office. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



Sage Grouse Habitat Conditions – Sage-Grouse Habitat within Field Office

Indicator for Nesting Habitat (Apr 1-Jun 30)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	0/7	0%
Sagebrush Height	0/7	0%
Perennial Grass Cover	6/7	86%
Forb Cover	2/7	29%

Indicator for Brooding Habitat (May 15-Sept 15)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	40/126	32%
Sagebrush Height	43/126	34%
Perennial Grass and Forb Height	83/126	66%

Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	317/409	78%

Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	157/269	58%
Soil stability under plants	183/281	65%

Clean Water and Stream Habitat – within Field Office

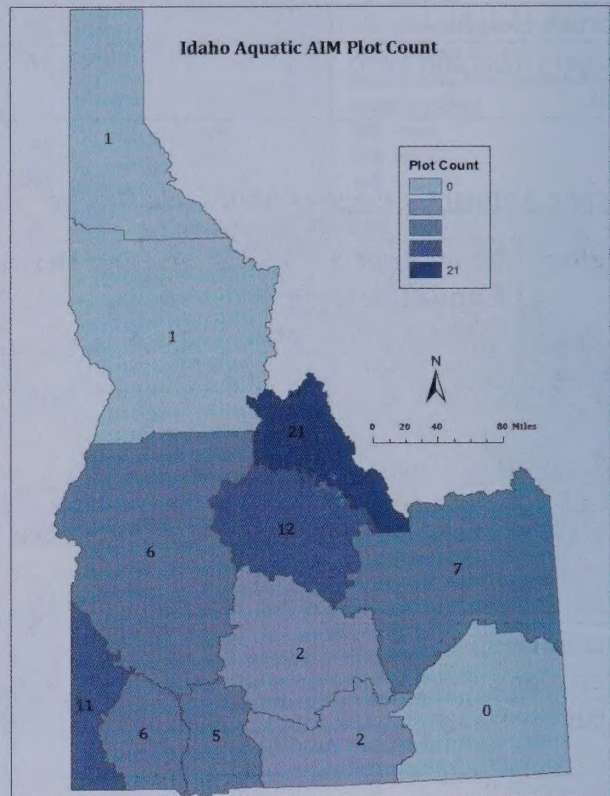
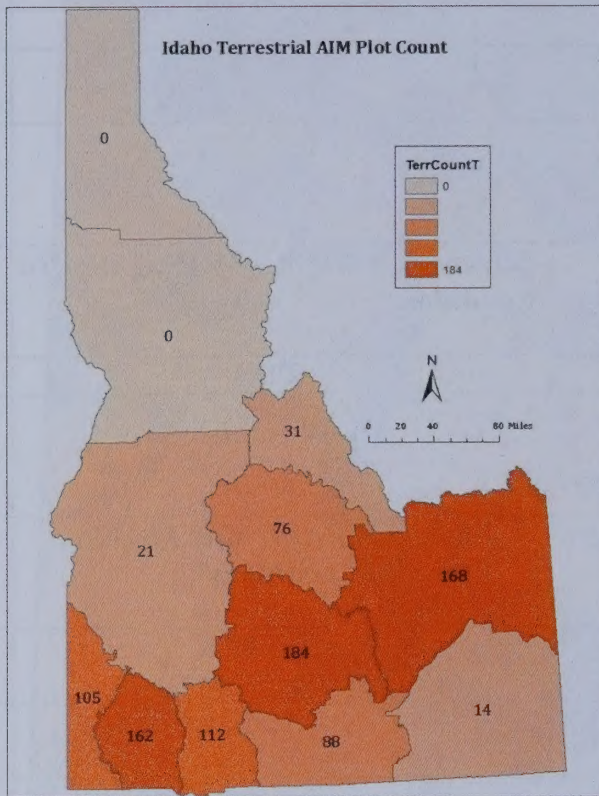
Indicator	Number of AIM Sites Meeting Desired Conditions^/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions^
Conductivity	1/15	7%
Fine Sediment	11/16	69%
Bank Stability	13/16	81%

*Desired conditions for terrestrial indicators were set using the following: 1. local **Resource Management Plan Amendment** for Greater Sage-Grouse; 2. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 3. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

^Desired conditions for water quality and stream habitat indicators were set using the following: 1. **modeling site-specific predictions** of the conductivity concentration that should naturally occur at a site (Olson and Hawkins, 2012); 2. the range of variability among networks of minimally impacted EPA and USGS **reference sites** by ecoregion for fine sediment (Stoddard et al. 2005); and 3. **professional judgment** and review of existing field office **policy** set bank stability benchmarks at 70 and 80% for arid and mesic regions, respectively.

IDAHO: BUILDING CONSISTENCY ACROSS MONITORING PROGRAMS

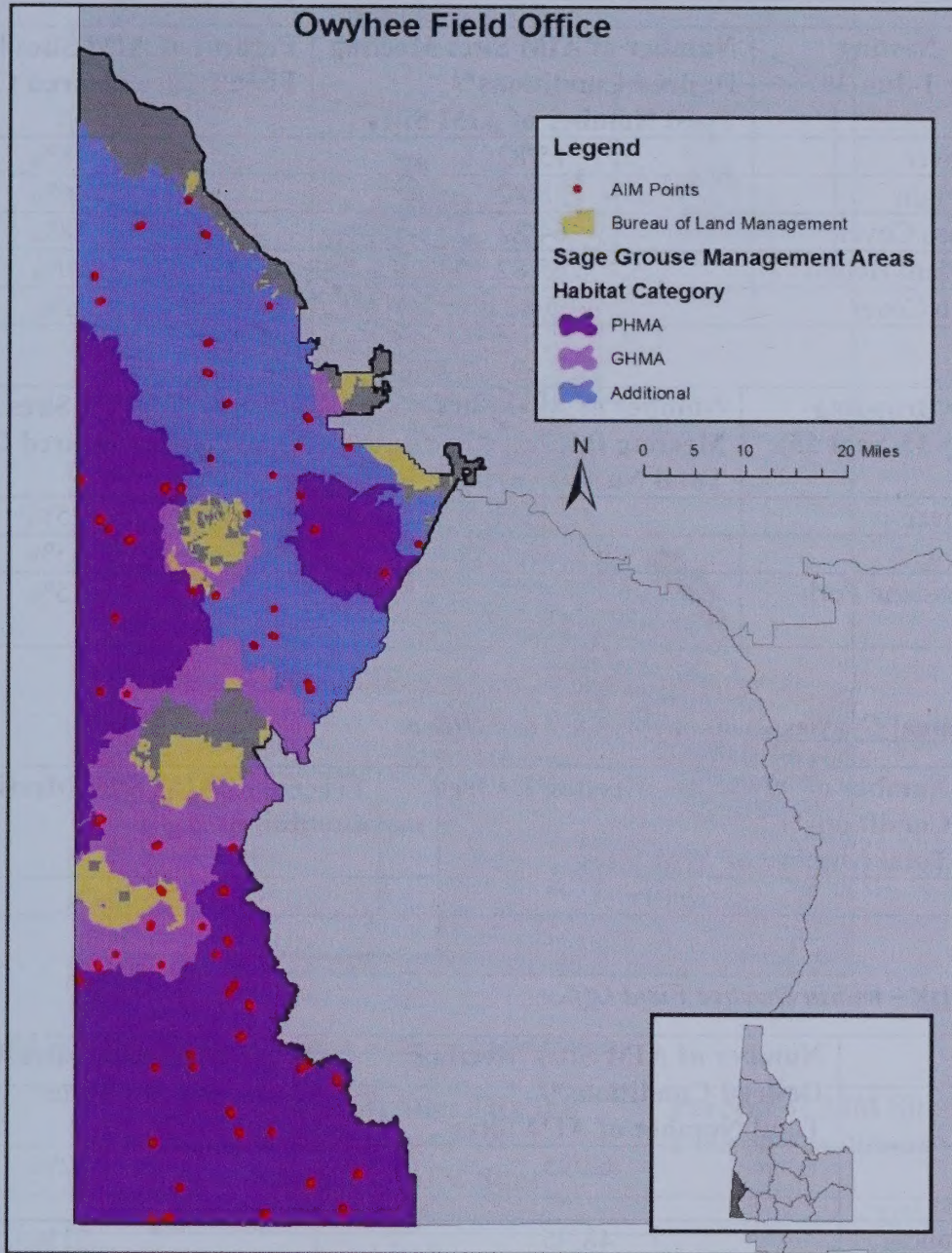
AIM DATA AVAILABLE NOW

**IDAHO AIM SUMMARY: Owyhee (Terrestrial) and Salmon (Aquatics) Field Offices**

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within several Idaho Field Offices. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Offices. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



Sage Grouse Habitat Conditions – Sage-Grouse Habitat within Owyhee Field Office

Indicator for Nesting Habitat (Apr 1-Jun 30)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	15/82	18%
Sagebrush Height	38/82	46%
Perennial Grass Cover	64/82	78%
Herbaceous Plant Height	65/82	79%
Perennial Forb Cover	5/82	6%

Indicator for Brooding Habitat (May 15-Sept 15)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	5/20	25%
Sagebrush Height	9/20	45%
Perennial Grass and Forb Cover	3/20	15%

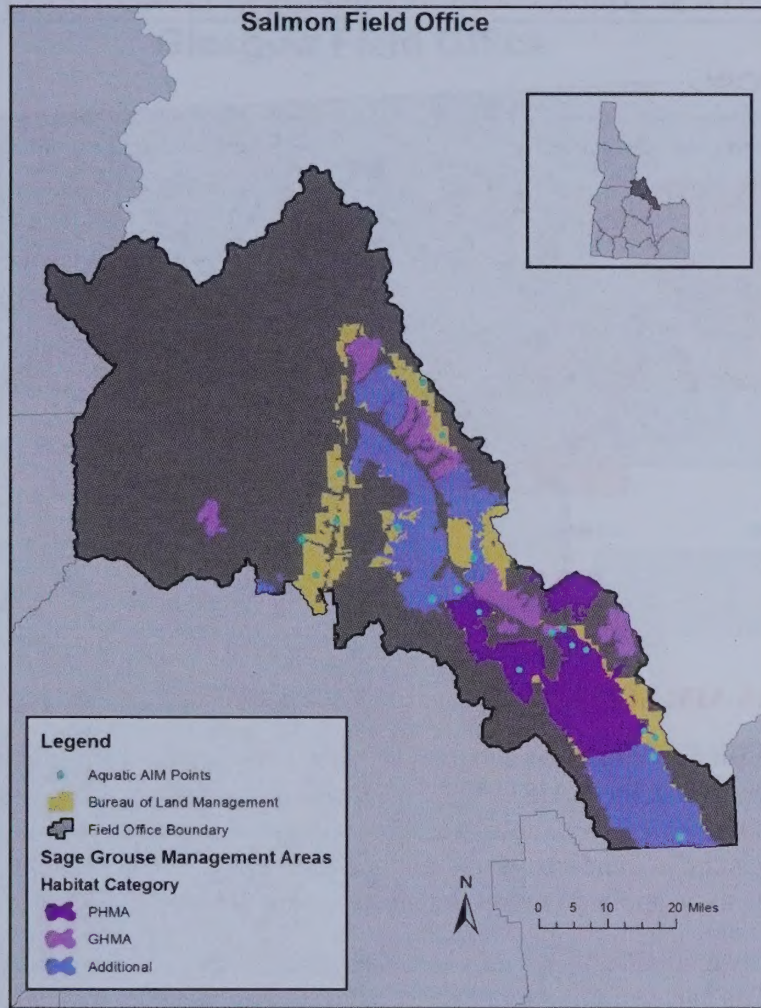
Fire-Prone Annual Grasses – within Owyhee Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	67/105	64%

Soil Erosion Risk – within Owyhee Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	68/95	72%
Soil stability under plants	48/95	51%

*Desired conditions for terrestrial indicators were set using the following: 1. local **Resource Management Plan Amendment** for Greater Sage-Grouse; 2. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 3. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).



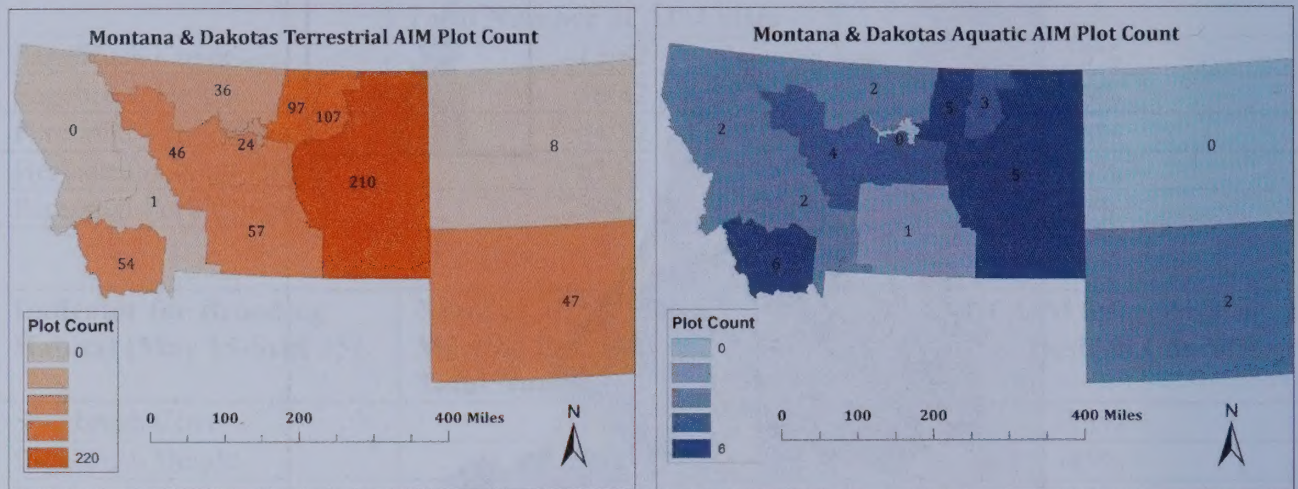
Clean Water and Stream Habitat – within Salmon Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions [^] / Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions [^]
Conductivity	4/18	22%
Fine Sediment	17/18	94%
Bank Stability (non-fish bearing)	11/13	85%
Bank Stability (fish bearing)	5/5	100%

[^]Desired conditions for water quality and stream habitat indicators were set using the following: 1. **modeling site-specific predictions** of the conductivity concentration that should naturally occur at a site (Olson and Hawkins, 2012); 2. the range of variability among networks of minimally impacted EPA and USGS **reference sites** by ecoregion for fine sediment (Stoddard et al. 2005); and 3. BLM policy for the Salmon field office sets bank stability benchmarks at 80% and 90% for non-fish bearing and fish bearing streams, respectively.

MONTANA/DAKOTAS: USING AIM TO INFORM LAND HEALTH

AIM DATA AVAILABLE NOW

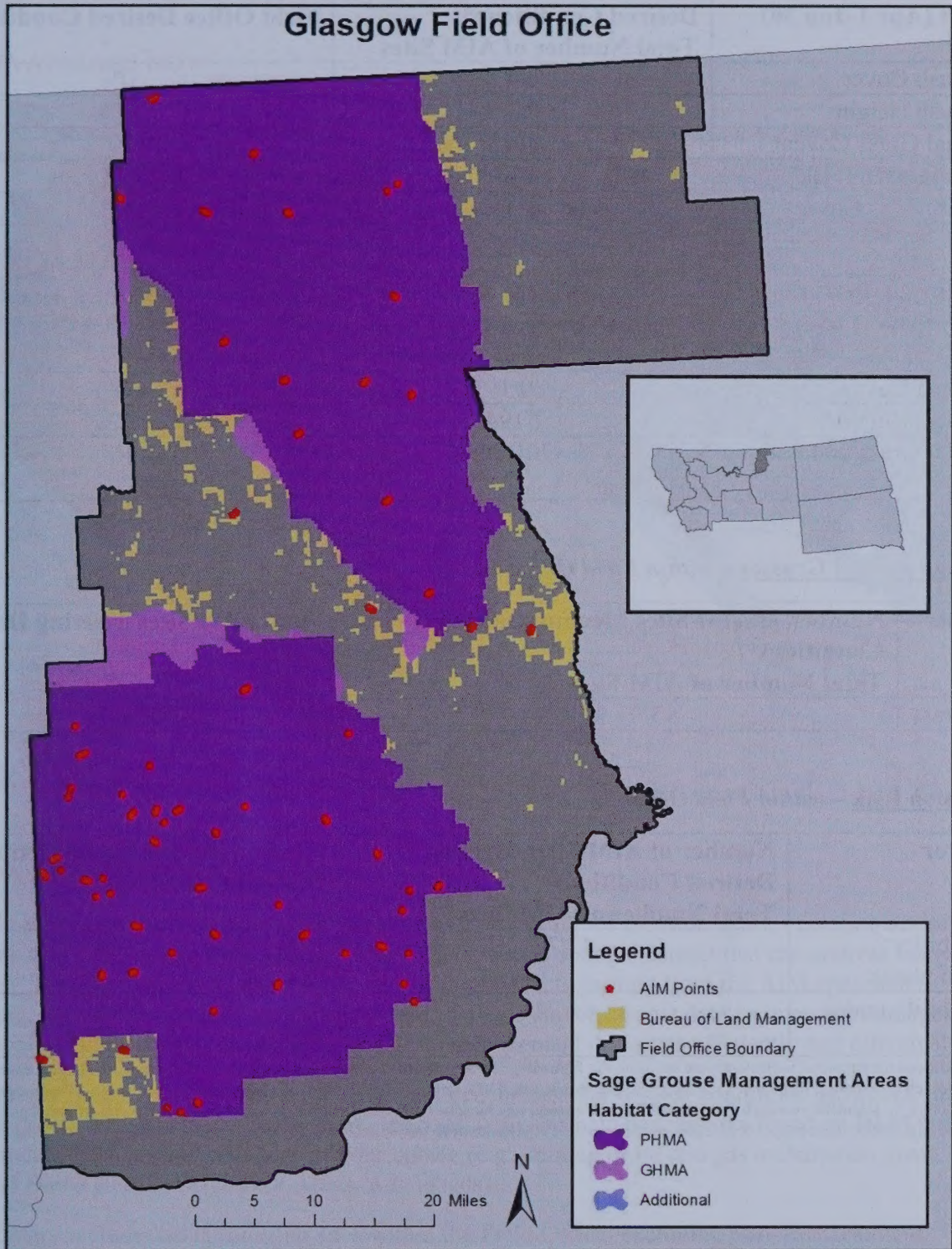


MONTANA/DAKOTAS AIM SUMMARY: Glasgow Field Office

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within a Montana/Dakotas Field Office. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. This analysis is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Office. Additional monitoring design information should be taken into account to generate statistical estimates of condition. Aquatics were not included in this analysis because total numbers are still low.



Indicator for Nesting Habitat (Apr 1-Jun 30)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	0/4	0%
Sagebrush Height	0/4	0%
Perennial Grass Cover	4/4	100%
Herbaceous Plant Height	4/4	100%
Perennial Forb Cover	4/4	100%

Indicator for Brooding Habitat (May 15-Sept 15)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	180/192	94%
Sagebrush Height	2/194	1%
Perennial Grass and Forb Cover	20/190	11%

Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	93/97	96%

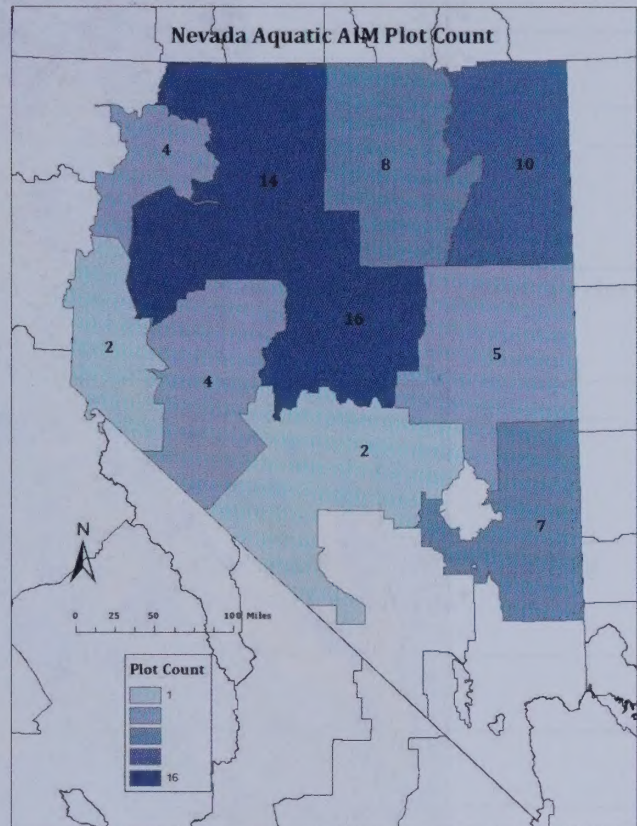
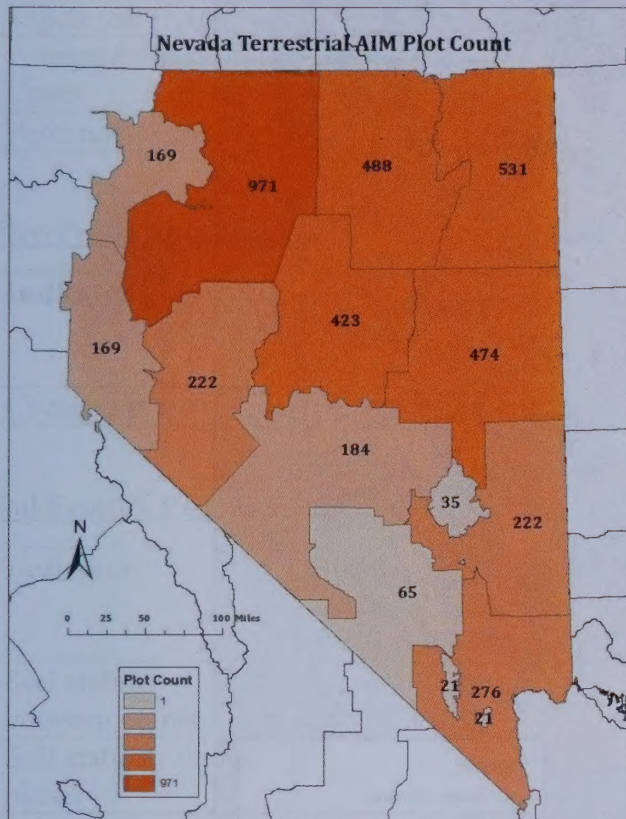
Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	47/76	62%
Soil stability under plants	64/94	68%

*Desired conditions for terrestrial indicators were set using the following: 1. local **Resource Management Plan Amendment** for Greater Sage-Grouse; 2. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 3. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

NEVADA: A LEADER IN AIM UTILIZATION

AIM DATA AVAILABLE NOW

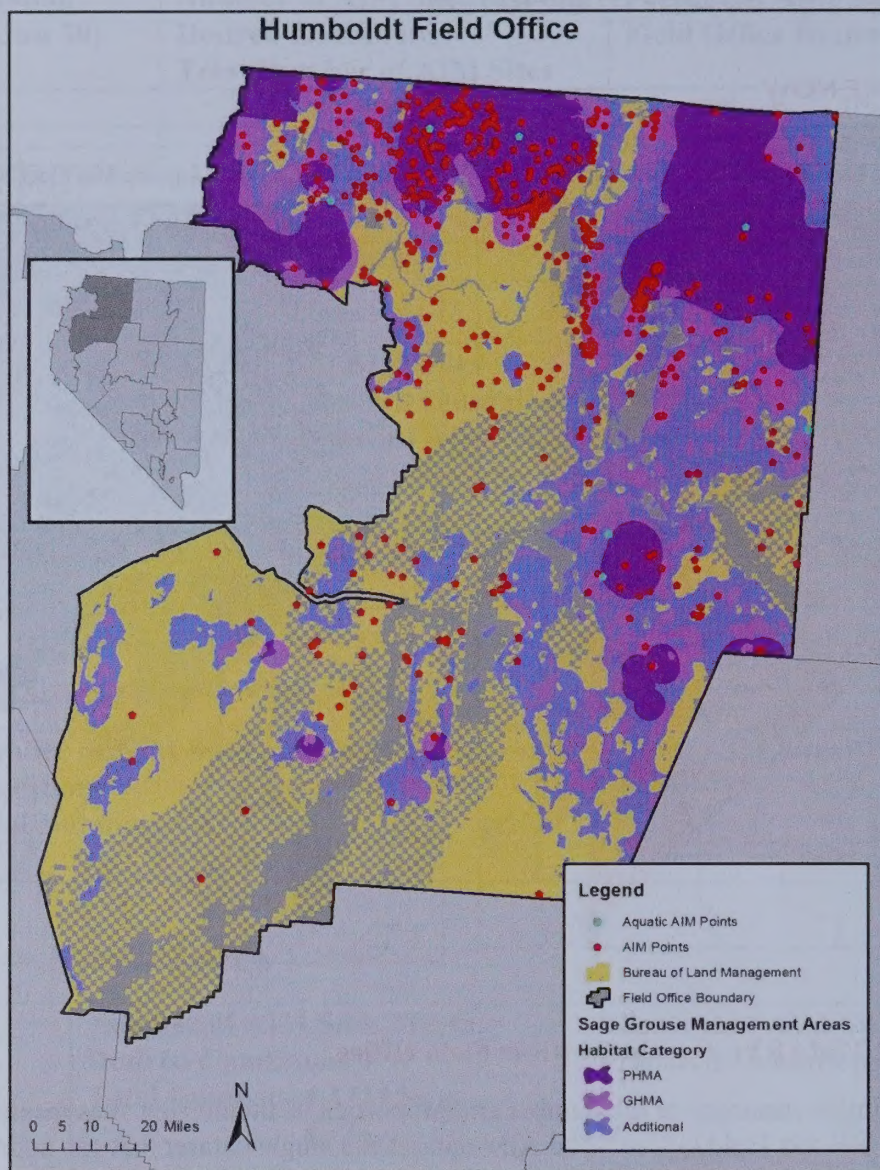


NEVADA AIM SUMMARY: Humboldt River Field Office

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within a Nevada Field Office. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Office, excluding post-fire treatment effectiveness sites. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



Sage Grouse Habitat Conditions – Sage-Grouse Habitat within Field Office

Indicator for Nesting Habitat (Apr 1-Jun 30)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	4/30	13%
Sagebrush Height	4/30	13%
Perennial Grass Cover	20/30	67%
Herbaceous Plant Height	28/30	93%
Perennial Forb Cover	3/30	10%
Invasive Annual Grass Cover	16/30	53%

Indicator for Brooding Habitat (May 15-Sept 15)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	210/560	38%
Sagebrush Height	118/560	21%
Perennial Grass and Forb Cover	326/560	58%
Perennial Forb Cover	63/560	11%

Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	360/971	37%

Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	358/602	59%
Soil stability under plants	350/602	58%

Clean Water and Stream Habitat – within Field Office

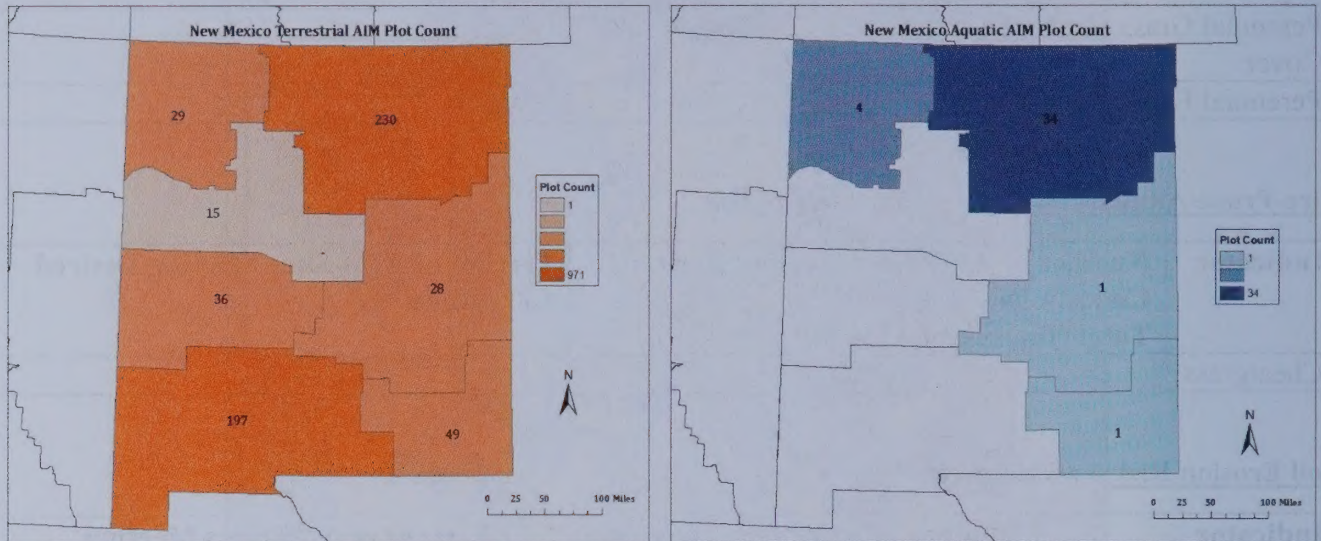
Indicator	Number of AIM Sites Meeting Desired Conditions^/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions^
Conductivity	5/14	36%
Fine Sediment	13/14	93%
Bank Stability	11/14	79%

*Desired conditions for terrestrial indicators were set using the following: 1. local **Resource Management Plan Amendment** for Greater Sage-Grouse and **Greater Sage-Grouse Habitat Assessment Framework** (Stiver et al. 2015); 2. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 3. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

^Desired conditions for water quality and stream habitat indicators were set using the following: 1. **modeling site-specific predictions** of the conductivity concentration that should naturally occur at a site (Olson and Hawkins, 2012); 2. the range of variability among networks of minimally impacted EPA and USGS **reference sites** by ecoregion for fine sediment (Stoddard et al. 2005); and 3. **professional judgment** and review of existing field office **policy** set bank stability benchmarks at 70 and 80% for arid and mesic regions, respectively.

NEW MEXICO: EXPANDING AIM THROUGH A DIVERSITY OF FUNDING SOURCES

AIM DATA AVAILABLE NOW

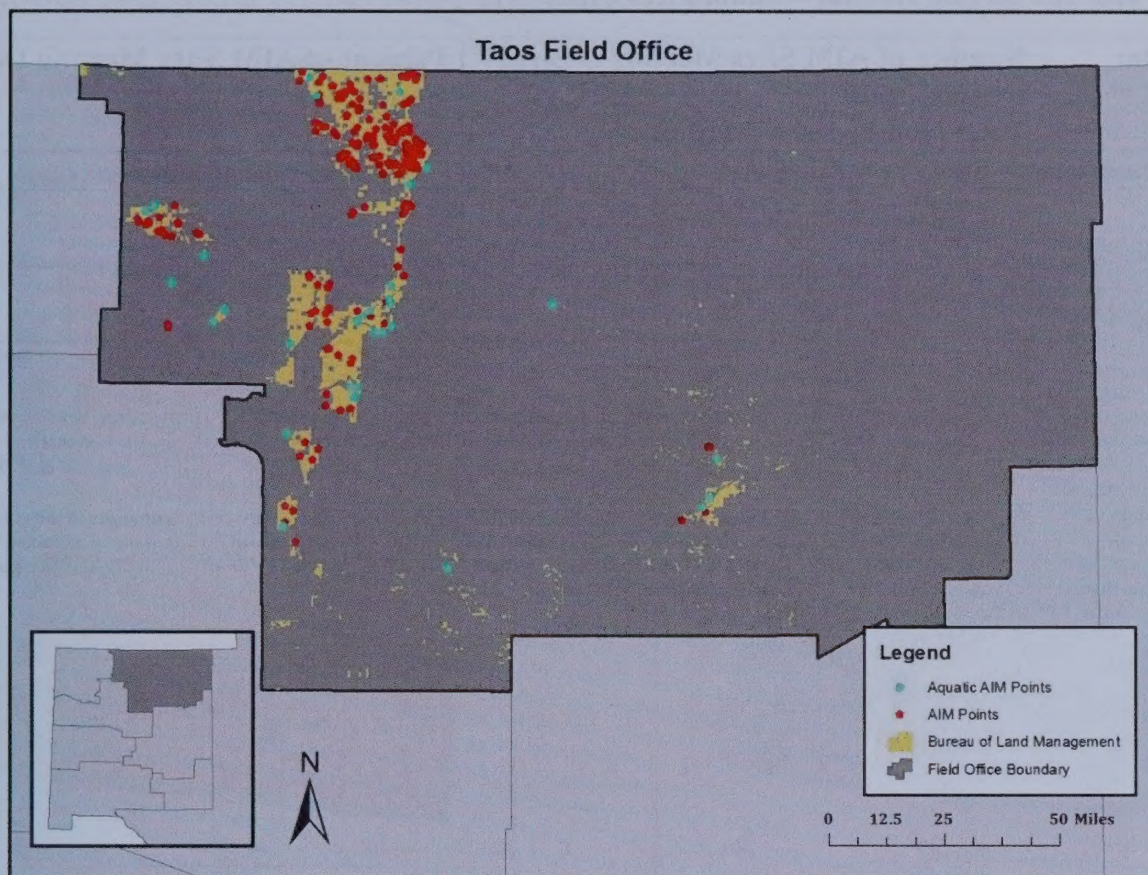


NEW MEXICO AIM SUMMARY: TAOS FIELD OFFICE

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within a New Mexico Field Office. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Office, excluding post-fire treatment effectiveness sites. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	230/230	100%

Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	117/227	52%
Soil stability under plants	132/220	60%

Clean Water and Stream Habitat – within Field Office

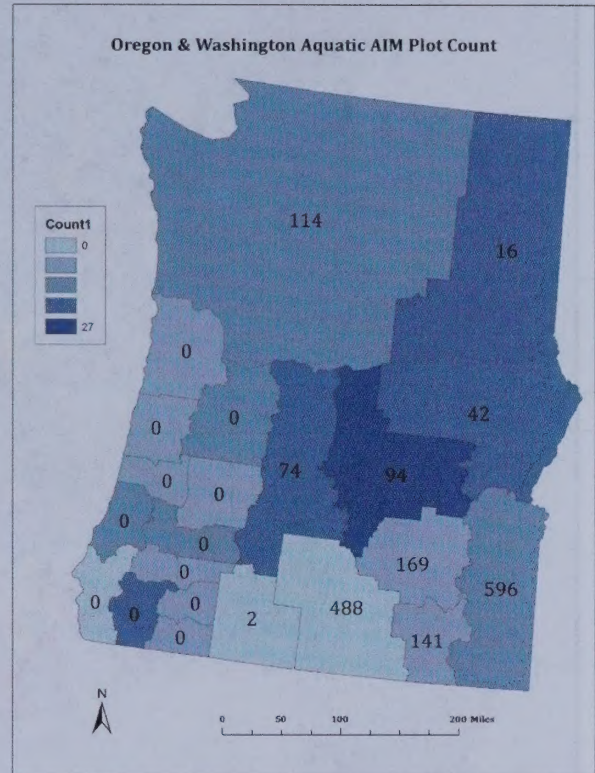
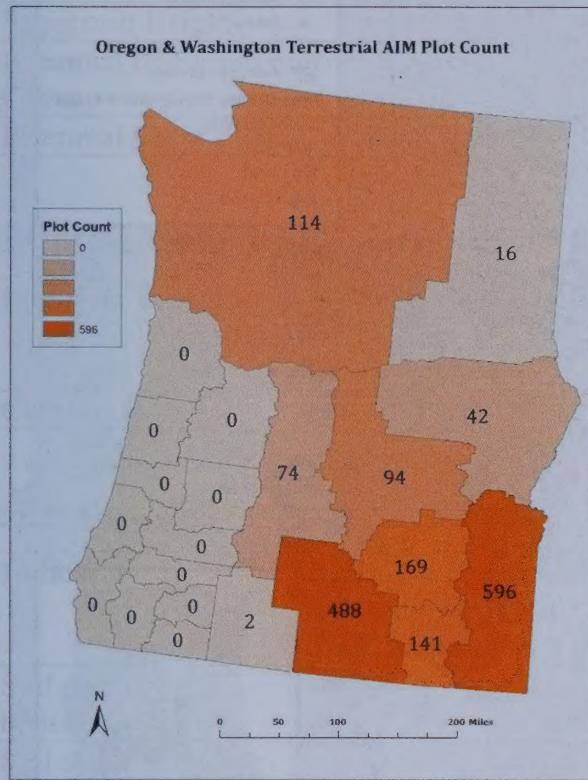
Indicator	Number of AIM Sites Meeting Desired Conditions [^] / Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions [^]
Conductivity	15/34	44%
Fine Sediment	33/34	97%
Bank Stability	13/31	42%

*Desired conditions for terrestrial indicators were set using the following: 1. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 2. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

[^]Desired conditions for water quality and stream habitat indicators were set using the following: 1. **modeling site-specific predictions** of the conductivity concentration that should naturally occur at a site (Olson and Hawkins, 2012); 2. the range of variability among networks of minimally impacted EPA and USGS **reference sites** by ecoregion for fine sediment (Stoddard et al. 2005); and 3. **professional judgment** and review of existing field office **policy** set bank stability benchmarks at 70 and 80% for arid and mesic regions, respectively.

OREGON/WASHINGTON: INVESTING IN AIM

AIM DATA AVAILABLE NOW

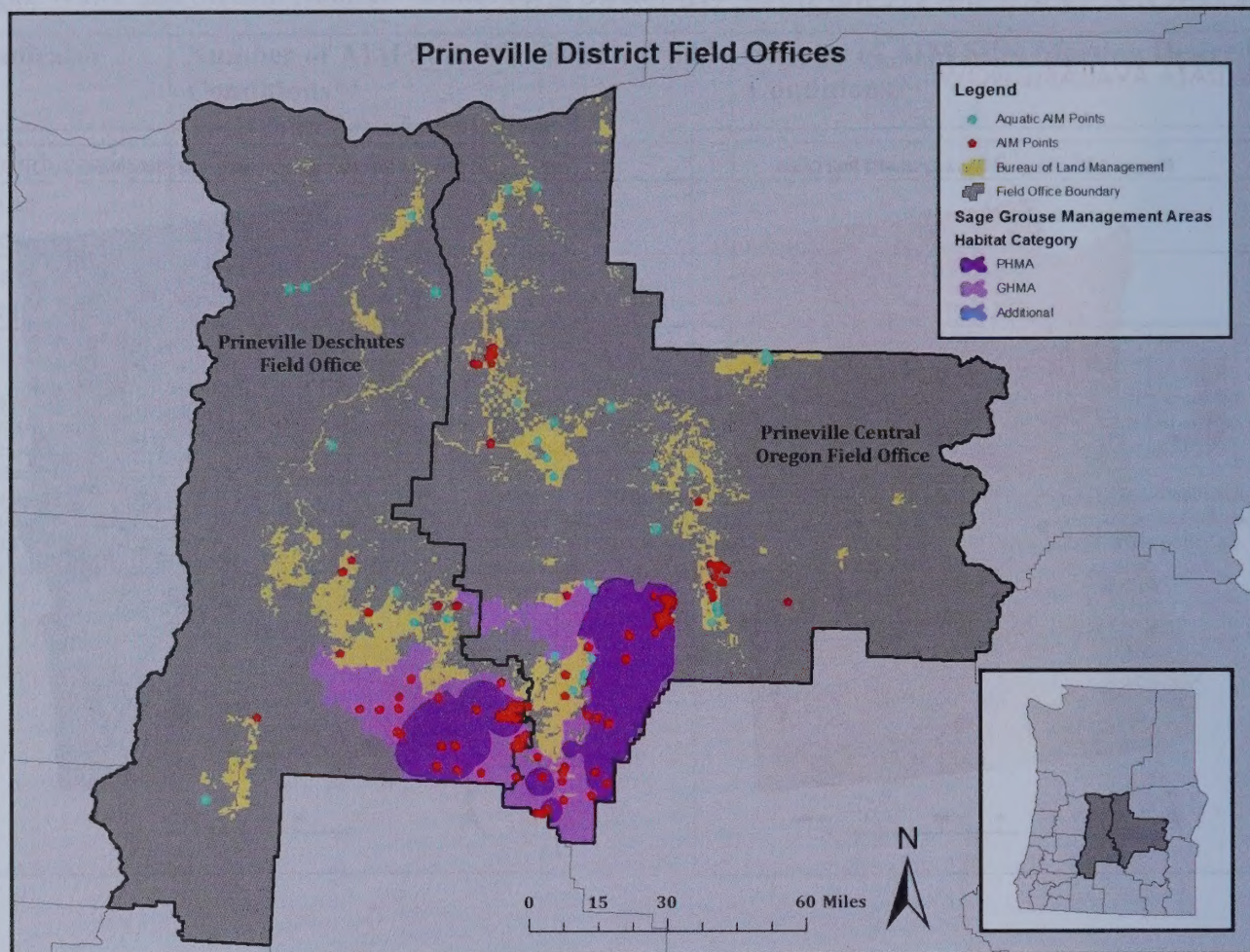


OREGON AIM SUMMARY: PRINEVILLE FIELD OFFICE

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within an Oregon Field Office. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Office, excluding post-fire treatment effectiveness sites. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



Sage Grouse Habitat Conditions – Sage-Grouse Habitat within Field Office

Indicator for Nesting Habitat (Apr 1-Jun 30)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	16/23	70%
Sagebrush Height	7/23	30%
Perennial Grass Cover	9/23	39%
Herbaceous Plant Height	10/23	43%
Perennial Forb Cover	23/23	100%

Indicator for Brooding Habitat (May 15-Sept 15)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	24/36	67%
Sagebrush Height	22/36	61%
Perennial Grass and Forb Cover	36/36	100%
Perennial Grass Cover	15/36	42%

Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	144/168	86%

Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	72/161	45%
Soil stability under plants	67/88	76%

Clean Water and Stream Habitat – within Field Office

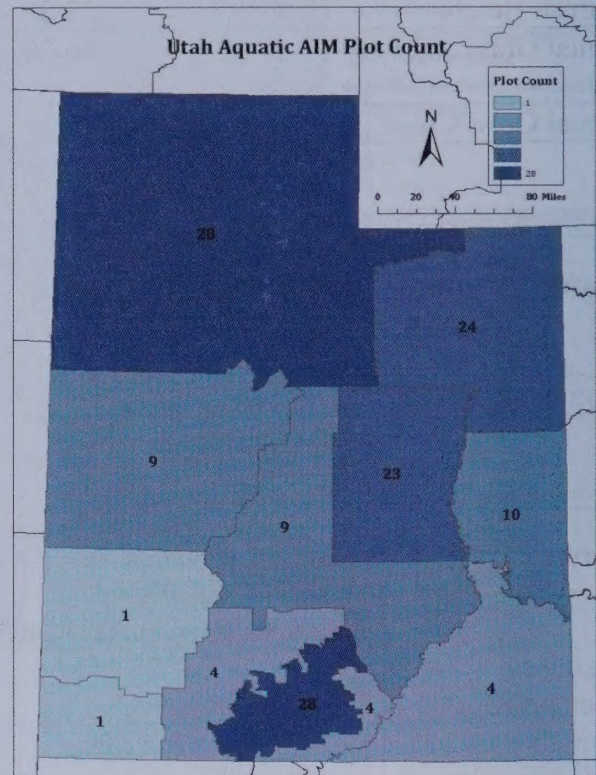
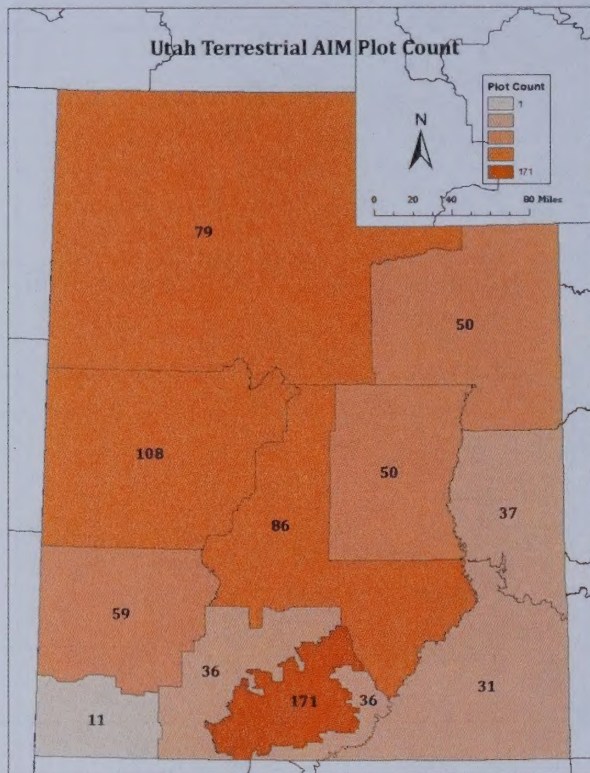
Indicator	Number of AIM Sites Meeting Desired Conditions^/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions^
Conductivity	16/35	46%
Fine Sediment	26/33	71%
Bank Stability	29/31	94%

*Desired conditions for terrestrial indicators were set using the following: 1. local **Resource Management Plan Amendment** for Greater Sage-Grouse and **Greater Sage-Grouse Habitat Assessment Framework** (Stiver et al. 2015); 2. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 3. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

^Desired conditions for water quality and stream habitat indicators were set using the following: 1. **modeling site-specific predictions** of the conductivity concentration that should naturally occur at a site (Olson and Hawkins, 2012); 2. the range of variability among networks of minimally impacted EPA and USGS **reference sites** by ecoregion for fine sediment (Stoddard et al. 2005); and 3. **professional judgment** and review of existing field office **policy** set bank stability benchmarks at 70 and 80% for arid and mesic regions, respectively.

UTAH: LEADER IN AQUATIC AIM AND EXPANDING TERRESTRIAL AIM

AIM DATA AVAILABLE NOW

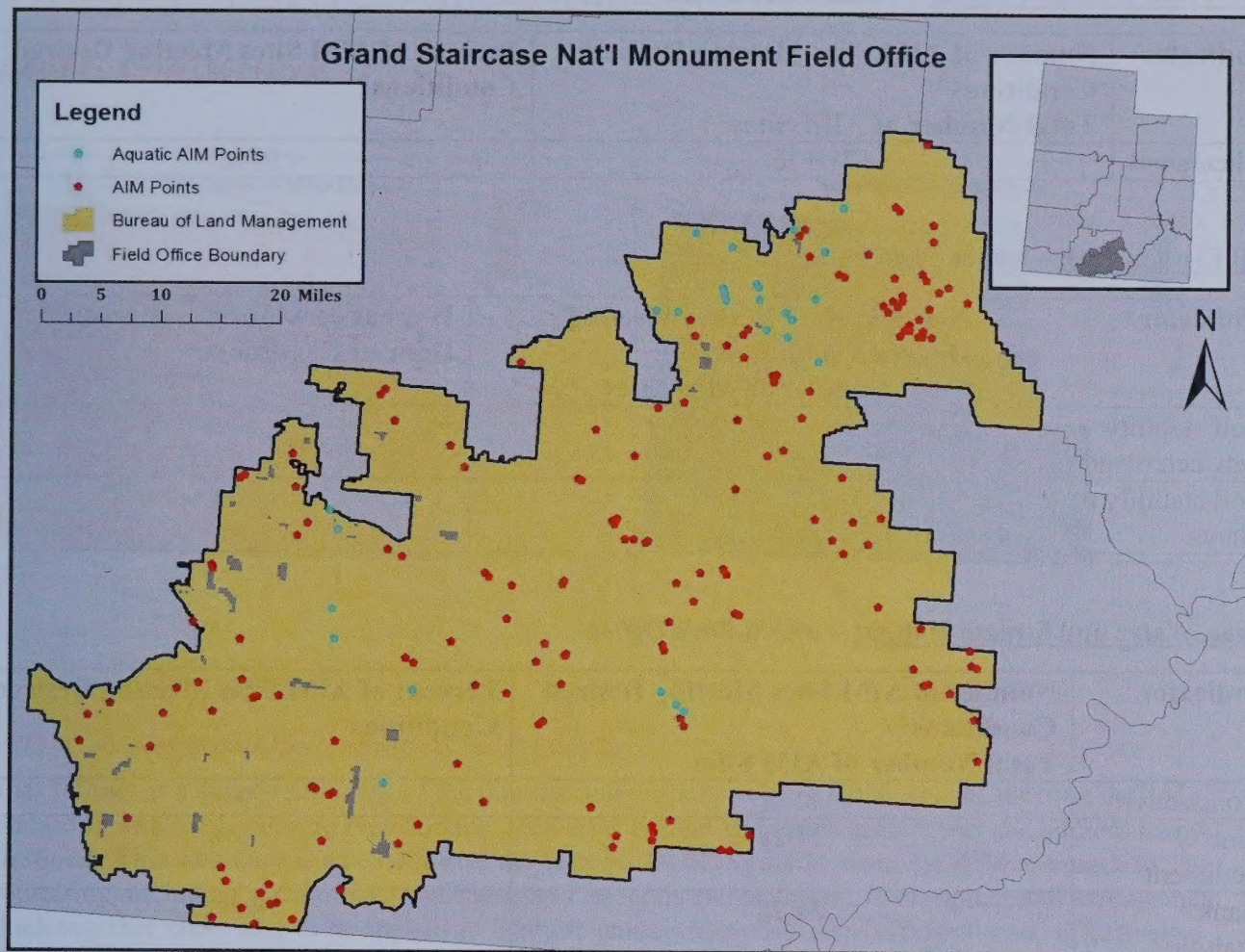


UTAH AIM SUMMARY: GRAND STAIRCASE-ESCALANTE NATIONAL MONUMENT

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within a Utah National Monument. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the National Monument, excluding post-fire treatment effectiveness sites. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	171/176	97%

Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	60/169	36%
Soil stability under plants	82/164	50%

Clean Water and Stream Habitat – within Field Office

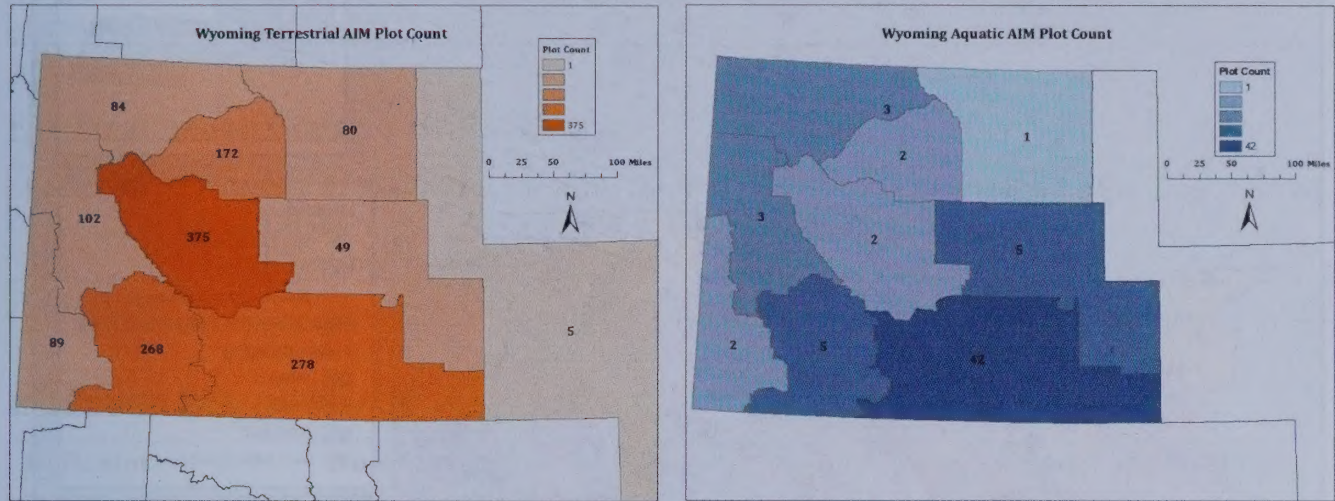
Indicator	Number of AIM Sites Meeting Desired Conditions^/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions^
Conductivity	8/28	29%
Fine Sediment	27/28	96%
Bank Stability	24/28	86%

*Desired conditions for terrestrial indicators were set using the following: 1. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 2. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

^Desired conditions for water quality and stream habitat indicators were set using the following: 1. **modeling site-specific predictions** of the conductivity concentration that should naturally occur at a site (Olson and Hawkins, 2012); 2. the range of variability among networks of minimally impacted EPA and USGS **reference sites** by ecoregion for fine sediment (Stoddard et al. 2005); and 3. **professional judgment** and review of existing field office **policy** set bank stability benchmarks at 70 and 80% for arid and mesic regions, respectively.

WYOMING: STATEWIDE AIM IMPLEMENTATION

AIM DATA AVAILABLE NOW

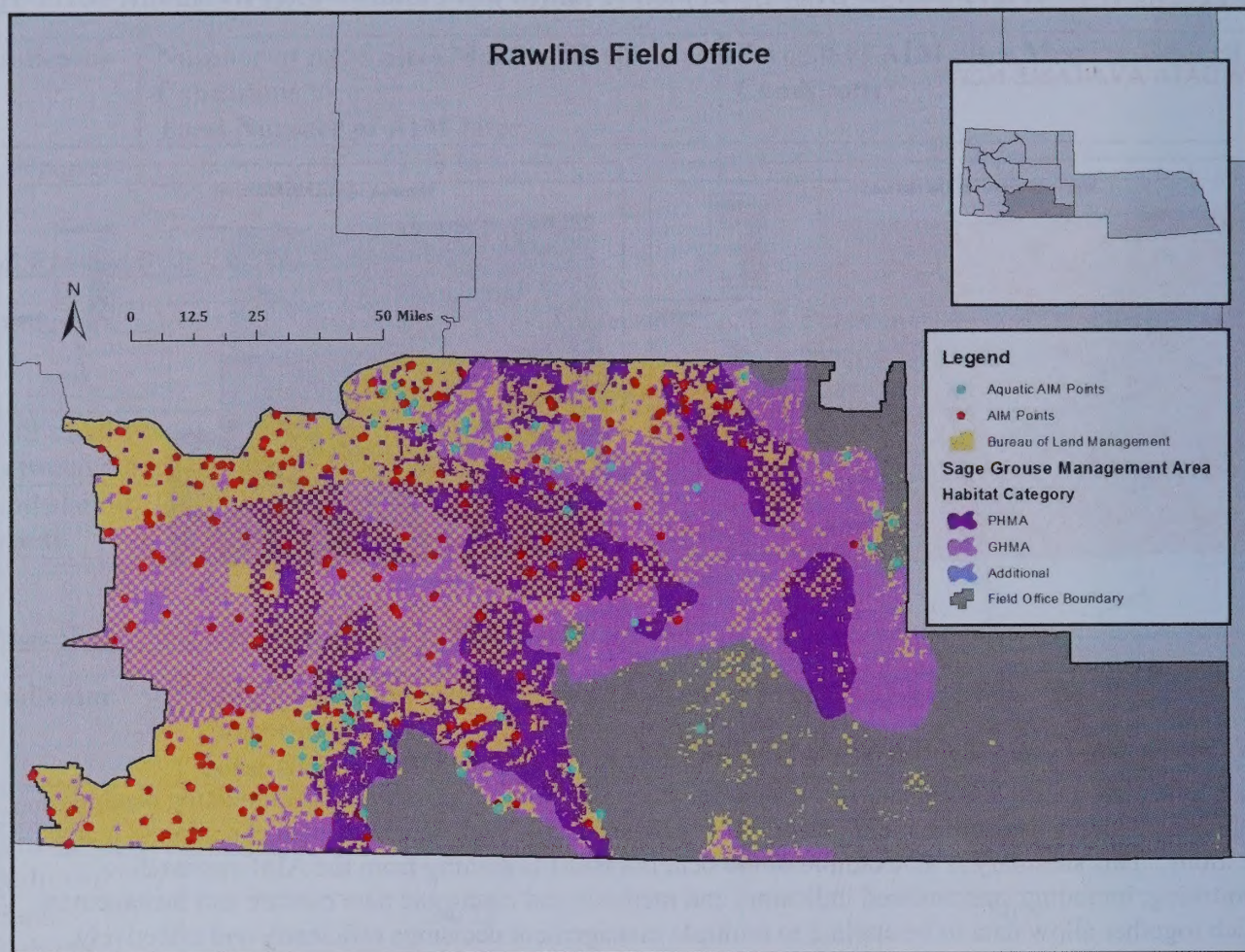


WYOMING AIM SUMMARY: RAWLINS FIELD OFFICE

What follows is a simple summary of the number and proportion of monitoring sites meeting desired conditions within a Wyoming Field Office. The AIM dataset is a single dataset that can address many questions. This summary is an example of the benefits BLM is gaining from the AIM approach to monitoring, including standardized indicators and methods and electronic data capture and management, which together allow data to be applied to multiple management decisions efficiently and effectively.

This summary used readily available polygons and benchmarks for desired condition. However, this is only a starting point. These data can easily be re-analyzed with alternate benchmarks based on BLM policy or management objectives and polygons of your choice (e.g., mining or oil and gas reclamation areas, Wild Horse and Burro Herd Management Areas, watersheds).

This summary includes all monitoring sites within the Field Office, excluding post-fire treatment effectiveness sites. Additional monitoring design information should be taken into account to generate statistical estimates of condition.



Sage Grouse Habitat Conditions – Sage-Grouse Habitat within Field Office

Indicator for Nesting Habitat (Apr 1-Jun 30)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	8/14	57%
Sagebrush Height	10/14	71%
Perennial Grass Cover	12/14	86%
Forb Cover	2/14	14%

Indicator for Brooding Habitat (May 15-Sept 15)	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Field Office Desired Conditions*
Sagebrush Cover	130/264	49%
Sagebrush Height	193/264	73%
Perennial Grass and Height	239/264	91%

Fire-Prone Annual Grasses – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Cheatgrass	270/278	97%

Soil Erosion Risk – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions*/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions*
Soil stability between plants	133/269	49%
Soil stability under plants	117/255	46%

Clean Water and Stream Habitat – within Field Office

Indicator	Number of AIM Sites Meeting Desired Conditions^/ Total Number of AIM Sites	Percent of AIM Sites Meeting Desired Conditions^
Conductivity	17/39	44%
Fine Sediment	18/42	43%
Bank Stability	42/42	100%

*Desired conditions for terrestrial indicators were set using the following: 1. local **Resource Management Plan Amendment** for Greater Sage-Grouse and **Greater Sage-Grouse Habitat Assessment Framework** (Stiver et al. 2015); 2. **scientific research** that showed that when a related grass species exceeded 10% cover, the probability of a sustained fire was about 50% in sagebrush steppe (Link et al. 2006); 3. **scientific research** that showed that soil erosion risk increases when soil stability is less than 4 under plants or less than 3 between plants (Arshad et al. 1996; Bestelmeyer et al. 2006; Schmalz et al. 2013; Reinhart & Vermeire 2016).

^Desired conditions for water quality and stream habitat indicators were set using the following: 1. **modeling site-specific predictions** of the conductivity concentration that should naturally occur at a site (Olson and Hawkins, 2012); 2. the range of variability among networks of minimally impacted EPA and USGS **reference sites** by ecoregion for fine sediment (Stoddard et al. 2005); and 3. **professional judgment** and review of existing field office **policy** set bank stability benchmarks at 70 and 80% for arid and mesic regions, respectively.

Application Examples

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WEST-WIDE PERENNIAL GRASS HEIGHT ACROSS GREATER SAGE-GROUSE RANGE

Background

To provide information for discussions with the livestock grazing community on the attainability of grass height benchmarks for Greater Sage-Grouse habitat, WO-200 requested an analysis of perennial grass height measurements in designated Greater Sage-Grouse habitat management areas (HMAs).

Management objectives

In the Greater Sage-Grouse plan amendments, perennial grass height is an important indicator of habitat condition.



- Habitat objectives tables in each plan amendment specify a benchmark for perennial grass height, by season, for wetter (mesic) and drier (arid) sites.

Implementation

- Existing AIM data collected 2011-2016 was used to produce this analysis. Effort included retrieving data from national databases, analysis, and producing and reviewing graphs and tables.

Results and Management Implications

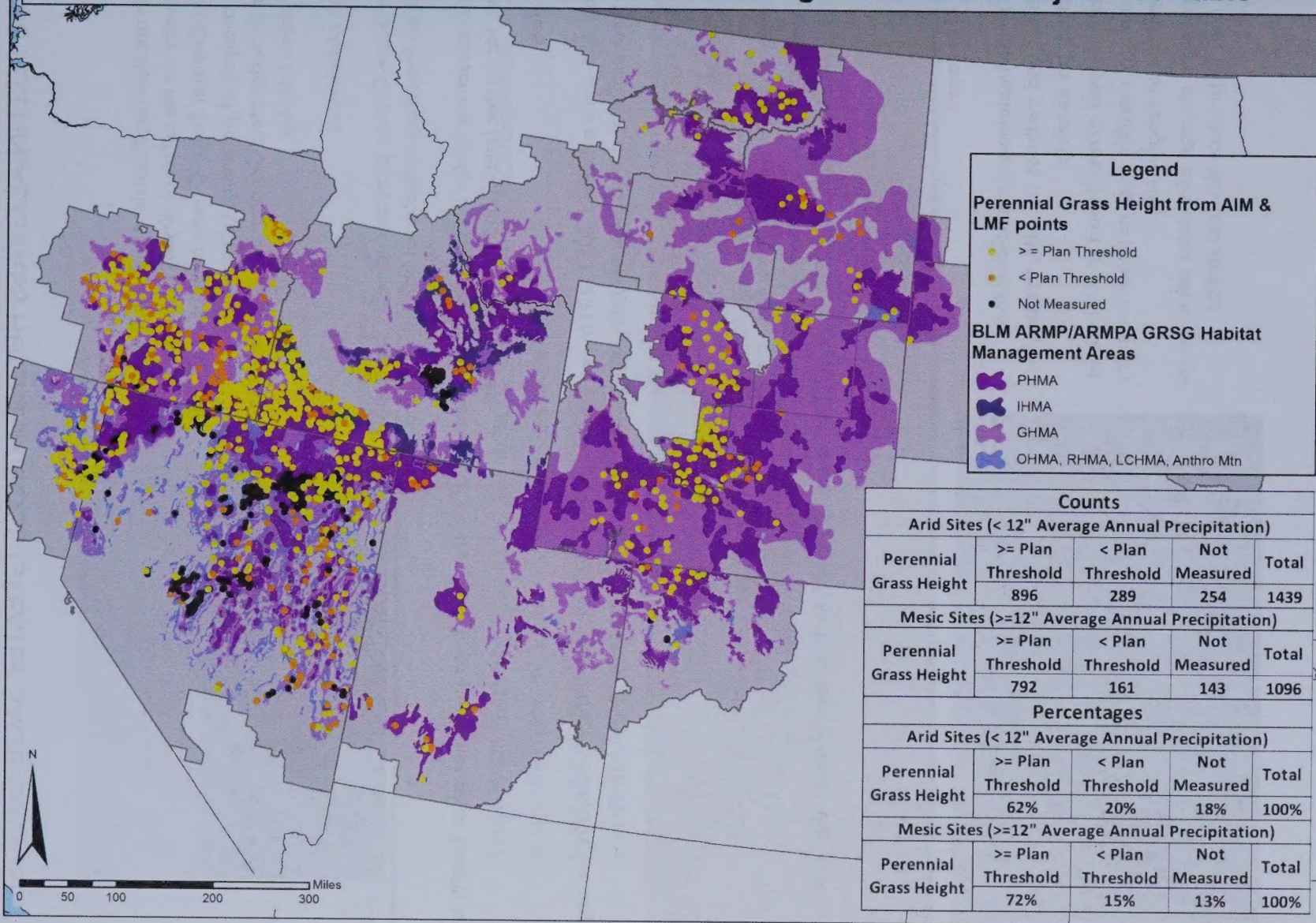
- The majority of sites were meeting the perennial grass height benchmark (see map).
- Mesic sites had a higher number of sites meeting the benchmark than did arid sites.
- Results provide science-based information for discussions with the livestock grazing community.**

Take Home Messages

- Prior to the implementation of standard indicators and methods via AIM, this analysis would not be possible.
- Similar analyses across broad spatial scales are similarly possible (e.g. national summary of condition of rangelands).
- Central data storage eliminates the need for data calls to produce this and similar analyses.



Perennial Grass Heights in Sage-Grouse Habitat Management Areas from AIM and LMF Points Sampled Between Dates Listed in Planning Area Habitat Objectives Table



BLM'S WESTERN RIVERS AND STREAMS ASSESSMENT

Background

Under the Federal Land Policy Management Act BLM is to manage the National System of Public Lands for multiple use and sustained yield. Sustained yield is to be assessed through periodic and systematic inventory of renewable resource condition and trend (Section 201 (a) 43 U.S.C. 1711(a) of FLPMA)). Under the AIM strategy the Western Rivers and Streams Assessment (WRSA) is being implemented to provide the Bureau with a first ever, unbiased assessment of the condition and trend of BLM streams and rivers throughout the contiguous U.S.

Management objectives

The WRSA is designed to answer three fundamental questions:

1. What percentage of BLM's streams and rivers have minimal, moderate, or major biological departure from reference condition?
2. What is the linear extent of streams and rivers experiencing stressors such as nutrient, salinity and fine sediment loading and invasive invertebrates?
3. What is the risk posed by the observed stressors to biological condition?

Implementation

- The WRSA was designed to speak to the condition and trend of the BLM's smallest headwater streams to the large rivers of the western U.S. such as the Colorado, Green, and Snake Rivers.
- Over 300 randomly located sites were sampled between 2013 and 2015 by trained youth field crews.

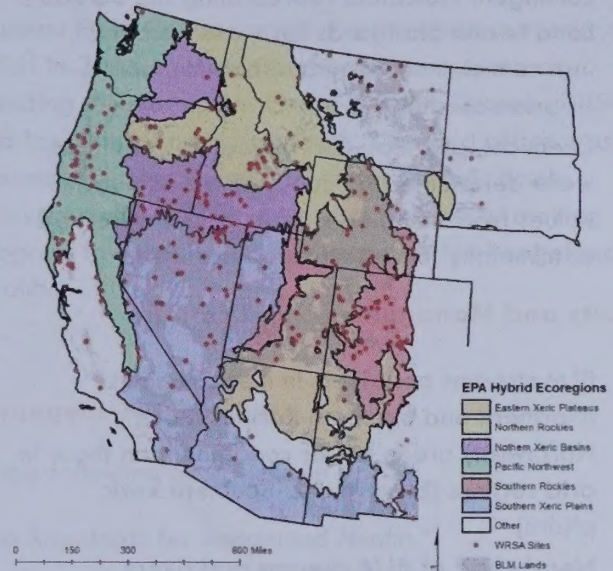
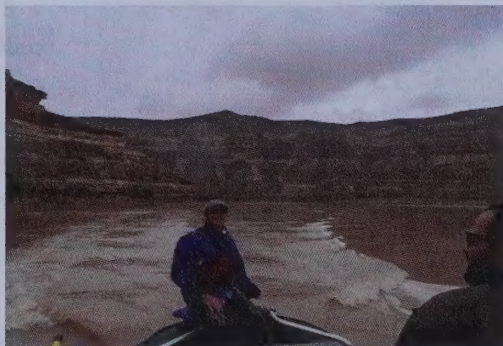


Figure 1. Spatial distribution of the more than 300 sites sampled between 2013 and 2015 under the first round of the WRSA. Point distribution and reporting is by seven hybrid level III ecoregions.



Implementation Cont.

- Crews measured AIM aquatic core and contingent indicators representing the Bureau's Land health Standards for water quality, instream channel form and habitat, and riparian condition
- Chemical, physical, and biological conditions were determined by comparing quantitative values from sampled sites to values observed at minimally impacted reference sites.

Results and Management Implications

- BLM streams and rivers in mesic regions (Northern and Southern Rockies, Pacific Northwest) are in better condition than those in arid regions (Eastern and Southern xeric plains).
- Nearly half of BLM streams and rivers experience excessive nutrient and salt (i.e., conductivity) loading.
- Water quality impacts and reduced instream habitat complexity are among the most pervasive stressors and most detrimental to biological condition.
- **Given the observed water quality impacts, collaborative, multi-agency approaches will be critical to diagnosing and restoring BLM streams and rivers.**

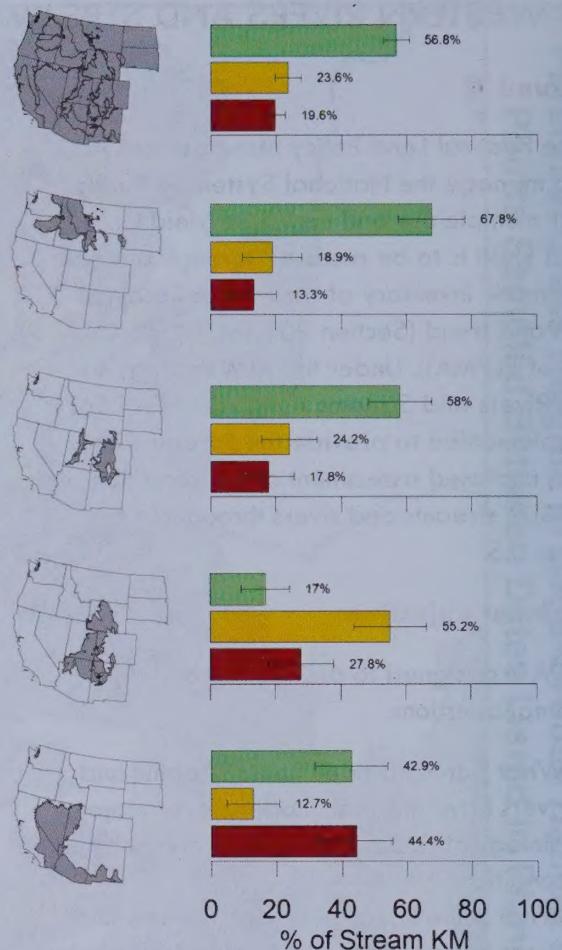


Figure 2. Canopy cover condition classes compared among three example ecoregions and for the western U.S. Condition classes are: minimal (green), moderate (yellow), and major (red) departure from reference.

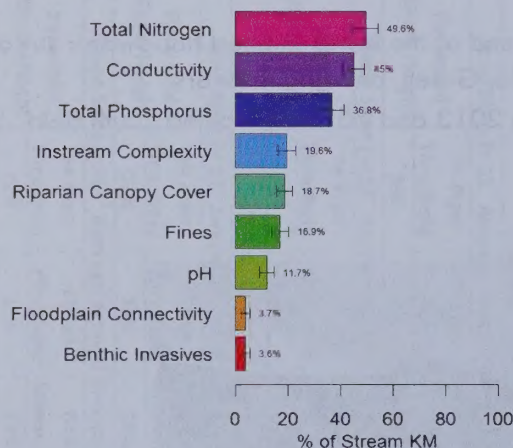


Figure 3. Spatial extent of BLM stream kilometers experiencing chemical, physical or biological stressor.

Next Steps

- BLM is working at the field office level in collaboration with state and federal partners to determine the causes of degraded stream and river conditions.
- BLM will repeat the WRSA from 2019 to 2021 to assess trends in the chemical, physical, and biological condition of stream and river systems.
- BLM is collaborating with the EPA and other state and federal agencies to identify efficiencies in stream and river monitoring.

LAND USE PLAN CONFORMANCE IN BRUNEAU, ID



Background

Bruneau Field Office began a multi-resource monitoring effort in 2015 to address management concerns, including monitoring for Greater Sage Grouse (GRSG) and land use plan conformance. The field office was interested in conserving and restoring sagebrush ecosystems for GRSG while also meeting or making progress toward the Idaho Standards for Rangeland Health.

Management objectives

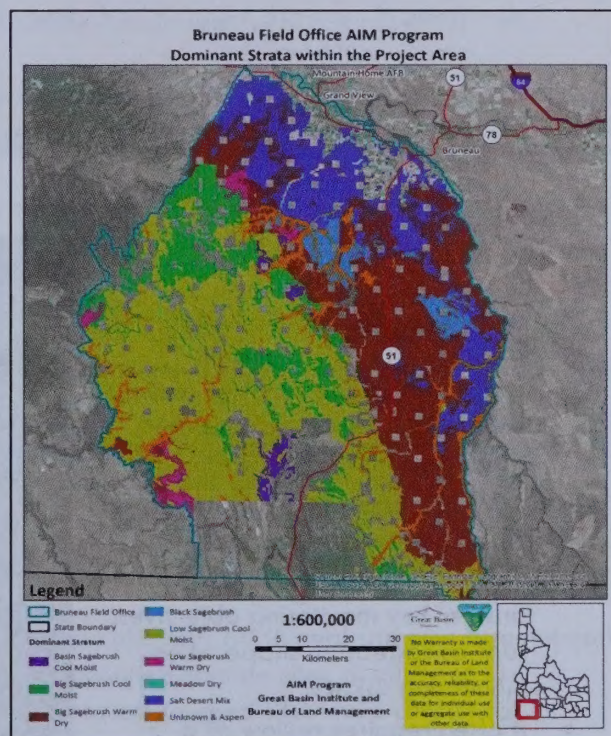
The field office monitoring effort is designed to inform the following management goals:

- “Meet or make progress toward meeting the Idaho Standards for Rangeland Health.”
- “Maintain and/or increase the abundance, distribution and connectivity of GRSG by conserving, enhancing and restoring GRSG habitat.”
- “Conserve, enhance and restore the sagebrush ecosystem upon which GRSG populations depend in an effort to maintain and/or increase their abundance and distribution, in cooperation with other conservation partners.”
- “Designate GRSG management areas and associated management to maintain a resilient population and to designate strategically located adjacent areas to provide a buffer from unpredictable habitat loss such as wildfire to the resilient population areas.”
- “Identify and strategically protect larger, intact sagebrush areas and areas of lower fragmentation to maintain GRSG population persistence.”

Implementation

Collected AIM terrestrial data as part of a multiscale monitoring effort.

- Terrestrial core indicators and methods plus forb frequency, basal gap and sagebrush shape.
- 33 plots in 2015 and 45 plots in 2016 for a total of 78 plots, 68 of which were in GRSG habitat.
- Plots were spread across the landscape by dominant ecological site group.



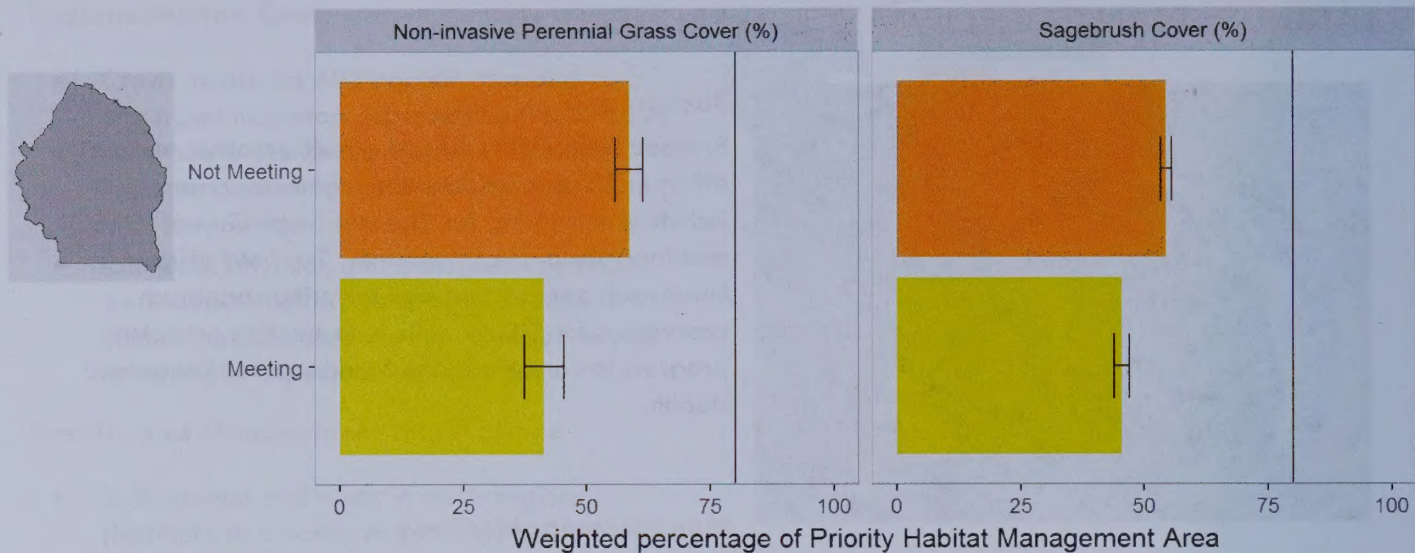


Figure 1. Status (meeting or not meeting) of two indicators (Non-invasive Perennial Grass Cover and Sagebrush Cover) within Priority Habitat Management Areas in the Bruneau Field Office. Non-invasive Perennial Grass Cover needed to be >10% in arid nesting and early brood rearing areas and >15% in mesic nesting and early brood rearing areas to be "Meeting." Sagebrush Cover needed to be 15-25% in nesting and early brood rearing areas and 10- 25% in late brood rearing areas to be "Meeting." Error bars represent an 80% confidence interval.

Results and Management Implications

- For these two indicators, the field office is not meeting the desired conditions (i.e., 80% of the field office meeting benchmark shown in graph as a gray vertical line).
- More indicators (e.g., sagebrush height, perennial forb cover, etc.) are needed for the field office to determine if they are meeting or making progress toward meeting the land use plan objectives including wildlife habitat.
- A next step is to determine when specific areas are not meeting the benchmarks and discuss adjustments to management in those areas.

Take Home Message

- AIM data can be collected to address attainment or non-attainment of the requirements set forth in the Approved Resource Management Plan Amendments.
- AIM data should be supplemented with additional indicators and methods in order to be able to answer key monitoring objectives, such as sagebrush shape when monitoring GRSG.
- It often requires review of a combination of indicators to determine whether or not a land health standard is being met.
- AIM data gives unbiased, quantitative data to help land managers make better management decisions.



USING AIM TO PRIORITIZE FIELD OFFICE MONITORING: WATER QUALITY MONITORING IN THE GREEN RIVER DISTRICT, UT

Background

Utah BLM Land Health Standards (LHS) require that rivers and streams meet water quality standards established by the State of Utah (R.317-2), Clean Water Act (33 U.S.C. § 1151, 1251-1387), Safe Drinking Water Act (42 U.S.C. § 300f), and the Colorado River Basin Salinity Control Act (PL 93-320). Previous AIM efforts in Utah identified water quality exceedances as problematic in the Green River District (GRD); however, more intensive monitoring was required to determine if water quality exceedances persist over time and the extent to which BLM permitted activities contribute to observed exceedances. The need for more intensive monitoring led to an ongoing collaborative effort between UTBLM and Utah Division of Water Quality (UDWQ), which has reduced UTBLM monitoring costs and allowed the UTBLM to leverage data being collected by the State.

Management objectives

Example management and monitoring objectives for this project include:

- Determine which streams and rivers in the GRD consistently fail to meet water quality land health standards.
- Determine the extent to which BLM permitted activities contribute to observed exceedances
- Work collaboratively with BLM partners to implement adaptive management efforts, where applicable, to improve water quality conditions.
- Implement a collaborative water quality monitoring project with UDWQ.

Implementation

- In general, monitoring sites were located at the upstream and downstream end of BLM-managed lands to determine the extent to which water quality exceedances, if observed, are related to BLM management activities.
- Previous AIM sampling identified water quality exceedances as the primary problem, as such only water quality indicators (e.g., pH, salinity, nitrogen, phosphorous) are being collected on systems identified as problematic.
- UTBLM collaborated with the Utah Division of Water Quality (UDWQ) to collect monthly water samples at 31 sites for one year.
- UDWQ is analyzing the samples at no cost to the BLM and collecting additional samples at a network of sites on non-BLM lands. The UDWQ had previously established sample sites at many of the locations of interest to the UTBLM. Whenever possible, these established sites were chosen for monitoring, in addition to establishing several new sites.

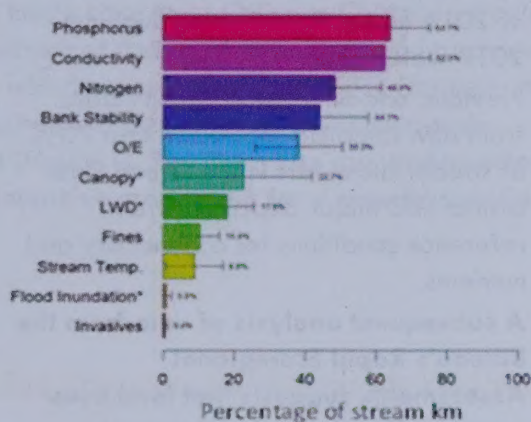


Figure 1. Extent of stressors with significant departure from natural conditions for AIM indicators measured throughout the State of Utah. Water quality stressors like phosphorous, Conductivity and Nitrogen were among the most widespread. Y-axis labels that are not intuitive include: macroinvertebrate scores (O/E), riparian canopy cover (canopy), large woody debris (LWD), fine sediment (fines) and invasive invertebrates (invasives).

Results and Management Implications

- Water quality sampling began in the fall of 2016 and will continue through the 2017 water year.
- Previous, one-time water quality data from AIM sampling suggested that 70% of stream kilometers in the Green River District had major departure from reference conditions for conductivity and nutrients.
- **A subsequent analysis of data from the Bureau's Rapid Ecoregional Assessments suggests that land uses such as oil and gas development, agriculture, and hydrological alterations are strongly correlated with water quality exceedances, especially excess salinity.**

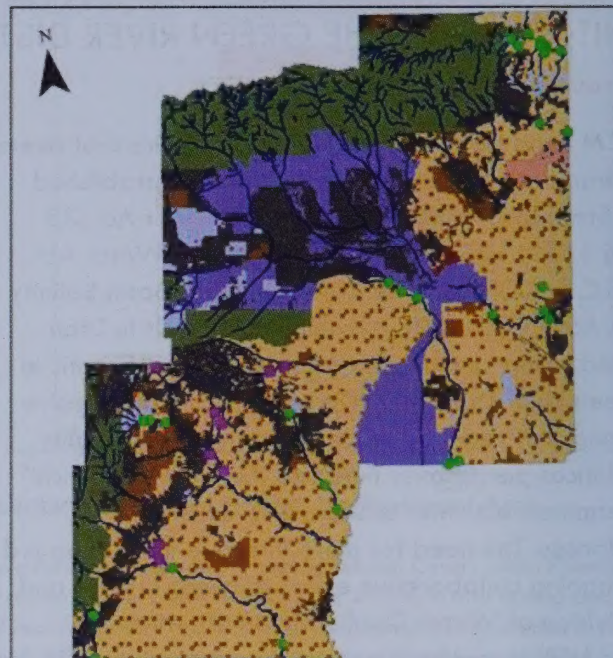


Figure 2. Map of the Green River District in Utah displaying land ownership, perennial streams and water quality monitoring locations established in partnership with the Utah Division of Water Quality during the 2017 water year.

Bureau of Land Management National Park Service Water

Next Steps

- Staff in the GRD will complete water quality sampling in the fall of 2017.
- Process water quality samples and QC data.
- Analyze data for exceedances and land-uses associated with observed exceedances.
- Determine the extent to which BLM activities are contributing to water quality exceedances versus those of our partners.
- Identify adaptive management and/or best management practices to improve water quality conditions.

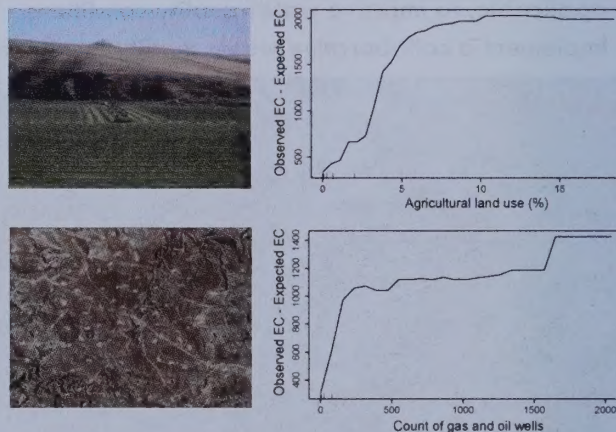


Figure 3. Conductivity exceedances as a function of percent agricultural land use (top) and the count of oil and gas wells within a watershed.

POST-FIRE TREATMENT EFFECTIVENESS MONITORING USING AIM



Background

After the 2012 Rush Fire burned 315,000 acres of critical wildlife habitat, the BLM Eagle Lake Field Office in California wanted to understand the success of their post-fire vegetation treatments. They teamed up with the Applegate field office (formerly the Alturas and Surprise field offices) to create a multi-scale monitoring effort (Figure 1). **The Rush Fire monitoring effort is an example of intensive monitoring for a specific question.**

Management objectives

Management objectives included the following from the [Rush Fire Emergency Stabilization and Rehabilitation: Environmental Assessment in 2012](#):

- “To reduce soil erosion, provide watershed stability, rehabilitate wildlife habitat, improve water quality, prevent off-highway vehicle incursions in the burn area, monitor and protect newly exposed cultural sites, monitor and prevent invasive plant infestations, facilitate regeneration of endemic plant species burned in the fire, and prevent human safety hazards.”

Implementation

Collected AIM terrestrial data as part of a multiscale monitoring effort (Figure 1). Monitoring focused on:

- Emergency Stabilization and Rehabilitation (ES&R) treatment areas within the Rush Fire boundaries, as well as untreated burned areas and unburned areas
- AIM terrestrial core indicators as well as density, a supplemental indicator. Plant density is an indicator of seedling establishment and helps determine how successful a seeding treatment is.

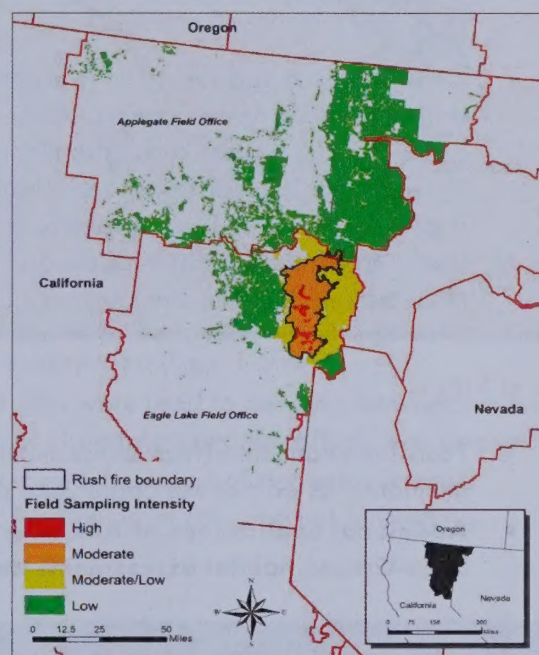


Figure 1. Monitoring point intensity within the Eagle Lake and Applegate monitoring effort. Post-fire treatment effectiveness intensification can be seen within the red polygons.

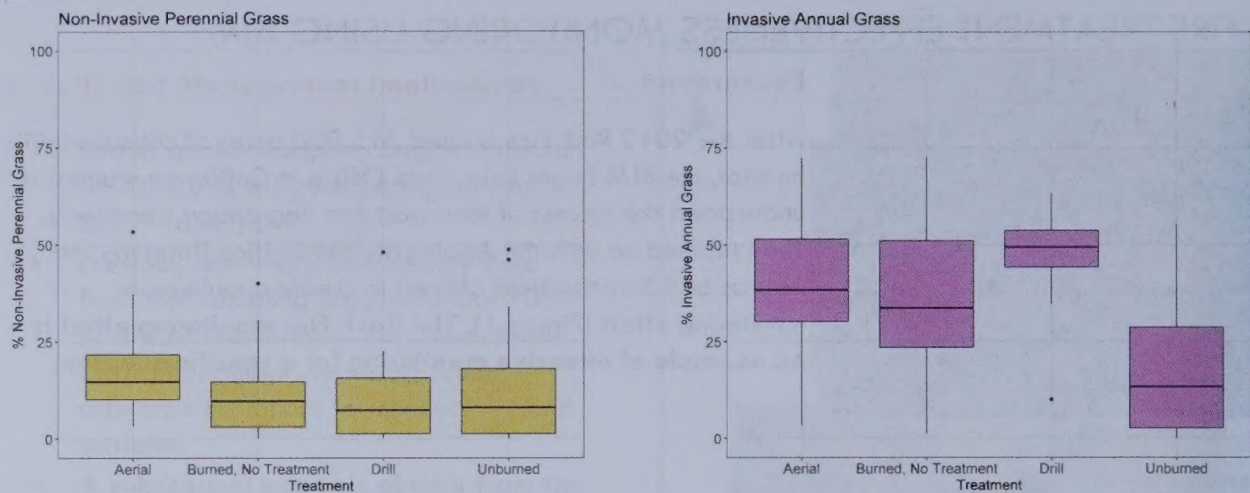


Figure 2. A comparison of vegetation seeding restoration treatments, untreated burned areas, and unburned areas surrounding the 2012 Rush Fire (95% confidence intervals).

Results and Management Implications

- Aerial seeding appears to have slightly improved outcomes relative to burned areas left untreated or drill seeded, after three years. Outcomes of aerial seeding include average increases in perennial grass cover, increases in soil stability, and decreases in bare soil (Figure 2).
- However, all burned areas are dominated by invasive annual grasses (Figures 2 and 3). They remain a threat to land health and wildlife habitat in the future. One reason for this may be that seeding treatments were carried out during drought which likely limited seedling success.
- Note that this analysis does not take into account differences in land type (ecological site).

Next Steps

- Post-fire treatment effectiveness monitoring is complete, but the Rush Fire burn area continues to be monitored as part of the Eagle Lake and Applegate multi-resource monitoring effort.
- **Additional applications of AIM data in these offices include grazing permit renewals, Greater Sage-Grouse habitat assessments and Land Use Plan effectiveness.**



Figure 3. Drill seeded area within the broader Rush Fire burn area in 2013. Invasive annual grasses are abundant.

STREAM RECLAMATION EFFECTIVENESS FOLLOWING PLACER MINING

Background

BLM policy states that stream and river habitats altered by placer mining should be rehabilitated to provide a stable channel form with adequate vegetation to reduce erosion, dissipate stream energy, and promote the recovery of instream and riparian habitats (43 CFR 3809.420 and H-3809-1). As part of a larger effort in Alaska, the Eastern Interior Field Office is using the AIM-National Aquatic Monitoring Framework (AIM NAMF) to quantify stream reclamation effectiveness following placer mining.

Management objectives

- Determine the effectiveness of stream reclamation efforts following placer mining.
- Identify, implement, and assess alternate reclamation practices as needed.

Implementation

- Sampled 14 mined and 31 unmined sites (Fig. 1)
- Chemical, physical, and biological AIM aquatic indicators measured from which conditions at reclaimed sites can be compared (Figs. 1 and 2).
- Quantitative conditions across the population of unmined sites were used to develop benchmarks (i.e., potential natural conditions) from which the effectiveness of stream reclamation efforts was assessed.
- The difference between indicator values at reclaimed sites and the range of potential natural conditions was used to make designations of functioning, functioning at risk, and not functioning.

Results and Management Implications

- Initial results highlight the inadequacy of many stream reclamation efforts, with significant alterations to water quality, riparian, and instream habitat persisting post-reclamation
- Of the 14 evaluated indicators, none were classified as 'functioning' across all 14 assessed reclamation reaches (e.g., Fig. 2).
- For the majority of reclaimed reaches, a stable stream channel had not been created. Thus, the desired instream and riparian habitat conditions were not created and are unlikely to exist under current conditions.

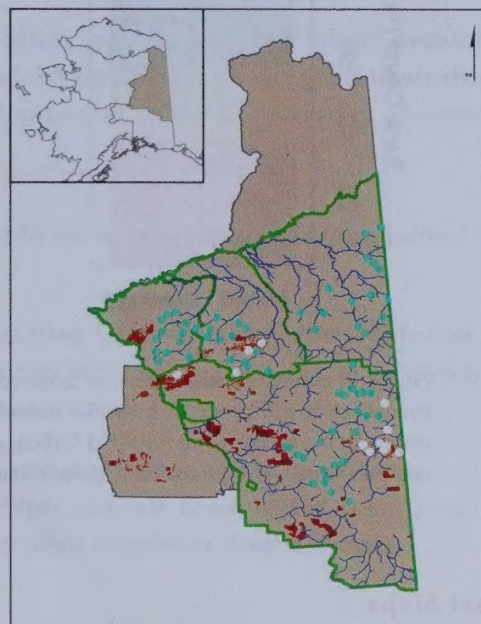


Figure 1. Probabilistic (teal) and targeted (white) sample points located in the Eastern Interior Field Office, AK. Blue lines represent major stream and river systems and red polygons, active placer mining claims.

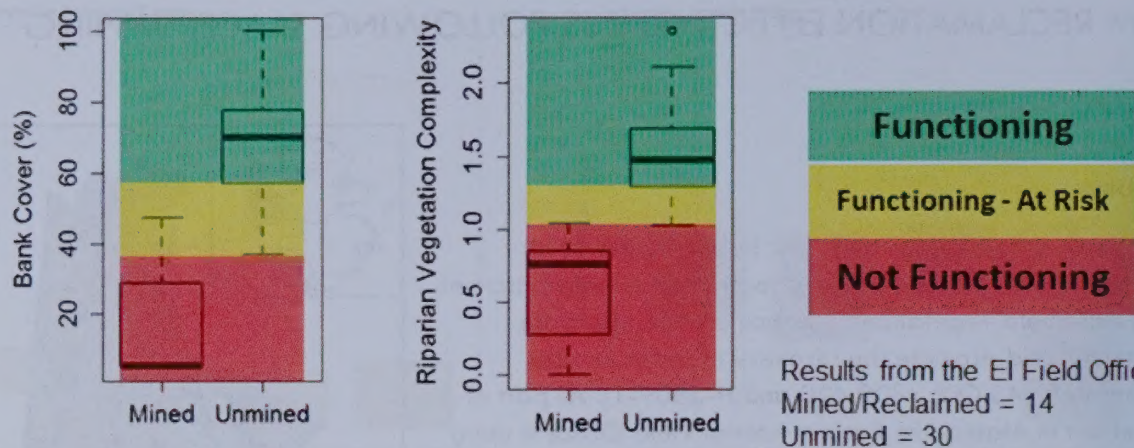


Figure 2. Example comparisons of bank cover and riparian vegetative complexity for mined sites post-reclamation compared to the range of potential natural conditions across unmined ('reference') sites throughout the Forty Mile region in the Eastern Interior Field Office, AK. Indicator values for mined sites falling below the 10th percentile of unmined sites were categorized as not functioning and reclamation objectives not achieved.

Next Steps

BLM Alaska is working with miners to implement new, innovative reclamation techniques to improve the effectiveness of reclamation efforts. These include actions such as:

- Improve floodplain connectivity by reducing the height of the low bank and relocating stream segments away from the valley walls or constraining features.
- Enhance bank cover and improve riparian habitat by transplanting willow clumps, installing brush mattresses on steep slopes, live staking, and seeding.
- Constructing pool habitat and enhancing pool formation through the addition of large woody debris to the stream channel.

AIM sampling is being used to assess the effectiveness of these new reclamation techniques – natural channel design. Preliminary results suggest that the use of natural channel design reclamation techniques are more likely to result in a stable stream channel and promote the recovery of instream and riparian habitat.



USING AIM DATA TO INFORM A GRAZING PERMIT RENEWAL



Background

The Elko, NV field office used AIM data to inform evaluation of land health standard attainment, as progress towards the renewal of a grazing permit on the Curtis Spring allotment.

Management objectives

Objectives are tied to Nevada standards for rangeland health:

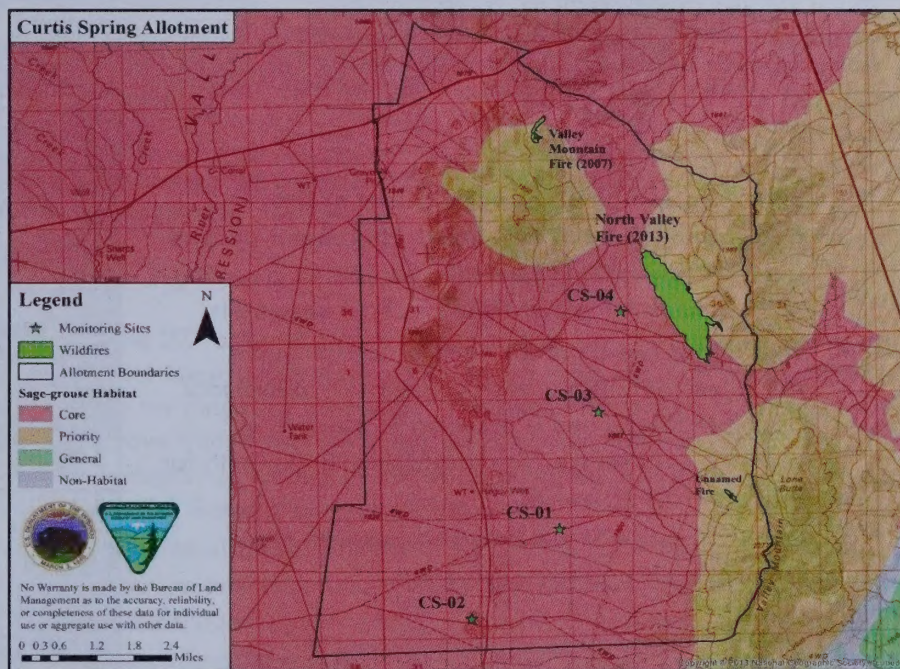
Standard 1, Upland sites: Upland soils exhibit infiltration and permeability rates that are appropriate to soil type, climate and landform.

Standard 3, Habitat: Habitats exhibit a healthy, productive, and diverse population of native and/or desirable plant species, appropriate to the site characteristics, to provide suitable feed, water, cover and living space for animal species and maintain ecological processes. Habitat conditions meet life cycle requirements of threatened and endangered species.

Implementation

Collected AIM terrestrial data as part of a multiscale monitoring effort.

- Two AIM sites (CS-03 and CS-04) were available in the allotment as a part of a broader monitoring effort.
- Two key area sites (CS-01 and CS-02) were established in 1991.
- Additional information available included allotment history, livestock actual use, photographs and utilization.



Both AIM plot and key area data were compared against benchmarks from Ecological Site Descriptions to assess standard attainment across a range of indicators (Figure 1).

Category		CS-03	CS-04
Foliar Cover	Black sagebrush	14.0	18.0
	Wyoming big sage	8.0	14.0
	Yellow rabbitbrush	2.0	--
	Winterfat	0.7	--
	Sandburg bluegrass	--	0.7
Total		24.7	32.7
ESD Estimated		10-20	15-20

Figure 1. *Example of data used for permit renewal. Foliar cover (%) at AIM plots CS-03 and CS-04. The "ESD Estimated" category shows the range in live cover values estimated in the Ecological Site Description (ESD), which served as a benchmark. Data were collected in June 2013.*

Take Home Message

- **AIM data can be an important part of the information used to determine attainment of land health standards.** In fact, the Elko District is putting AIM at the forefront of Land Health Assessments.
- The field office depends on AIM data to make reasoned, defensible decisions relative to livestock permit renewals and is planning to use it as a primary data source for determining land health for future permit renewals.
- In most cases, AIM will be combined with other available data, such as use data.

Figure 2. *Assessment, Inventory, and Monitoring (AIM) site CS-04, transects A) 1, B) 2, and C) 3. Photos were taken on 11 June 2013.*

Results and Management Implications

- Based on AIM and other data, sites were meeting upland standards.
- The habitat standard was not being met due to an overall lack of grasses and forbs.
- The field office determined that livestock was a contributing factor to non-attainment of standards due to exceedance of utilization objectives.



REMOTE SENSING AND AIM

Remote sensing is the study of an object, area, or phenomena without being in direct contact with that feature. BLM uses a variety of remote sensing sensors and platforms to map and monitor natural resources at multiple temporal and spatial scales. Remote sensing provides datasets that support, complement, inform, and supplement the overall objectives of the AIM Program. In some instances, remote sensing is the only means by which we can collect the data needed to meet our monitoring requirements. Below are four examples of how remote sensing is being used within the AIM Program to assist BLM meet objectives.

Grassland/Shrubland Mapping

- West-wide mapping effort in partnership with the USGS and other federal agencies to develop series of spatially explicit monitoring indicators including percent shrub, percent sagebrush, percent big sagebrush, percent herbaceous, percent annual herbaceous, percent litter, percent bare ground, shrub height and sagebrush height.
- These products are being used for multiple purposes (e.g, sage-grouse monitoring and reporting) within the Bureau including detection of gradual change, determine suitability of habitat, and over time assist with determining the effectiveness of actions at landscape scale.

FIGURE 1: MAP OF GRASSLAND/SHRUBLAND EXTENT INCLUDING TRAINING AND VALIDATION SITES.



FIGURE 2: FRACTIONAL COVER DATASETS INCLUDING THE PERCENT COVER OF BARE GROUND, HERBACEOUS (GRASS AND FORBS), LITTER, SAGEBRUSH, AND SHRUBS

Landscape Metrics



FIGURE 3: MAP OF SAGEBRUSH AVAILABILITY BEING USED TO SUPPORT MID-SCALE MONITORING FOR SAGE-GROUSE

- Of the 27 formal data requests for AIM Data, 11 have come from remote sensing groups wanting to leverage the high quality field data for mapping purposes. The LANDFIRE program is using to improve their existing vegetation products, which in turn BLM leverages for variety of needs including the Sagebrush Availability layer for Sage-grouse reporting
- Remote sensing combined with field data for training and validation are the primary inputs into mapping vegetation across the landscape
- Connectivity, habitat fragmentation are key indicators associated with BLM's Habitat Assessment Framework (HAF) that can only be measured via remotely sensed derived products.

Time Series Analysis

- Remote sensing information collected over multiple years – or even decades – can be used to provide context informing historical landcover trends, and vegetation condition, of managed lands.
- Remotely sensed spectral indices can be calculated and analyzed for AIM samples, allotments, or any geographic point or area, to identify landcover disturbances, and vegetation recovery trends

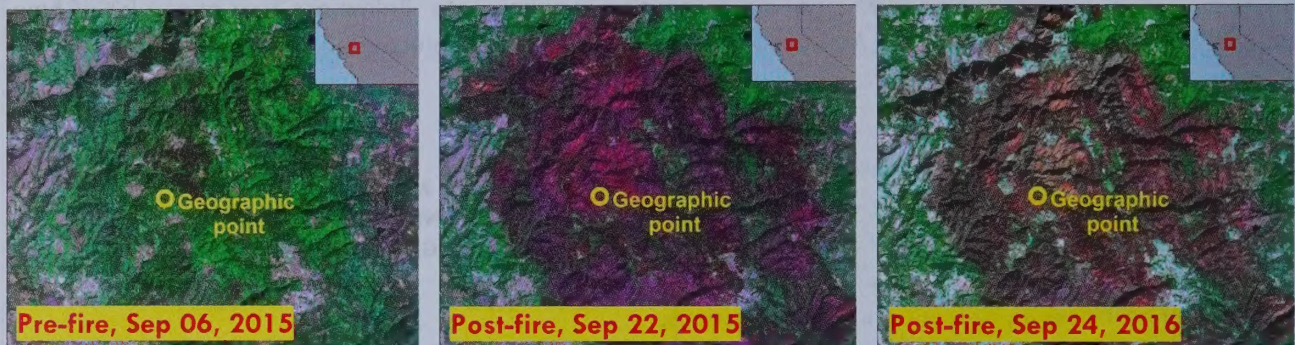
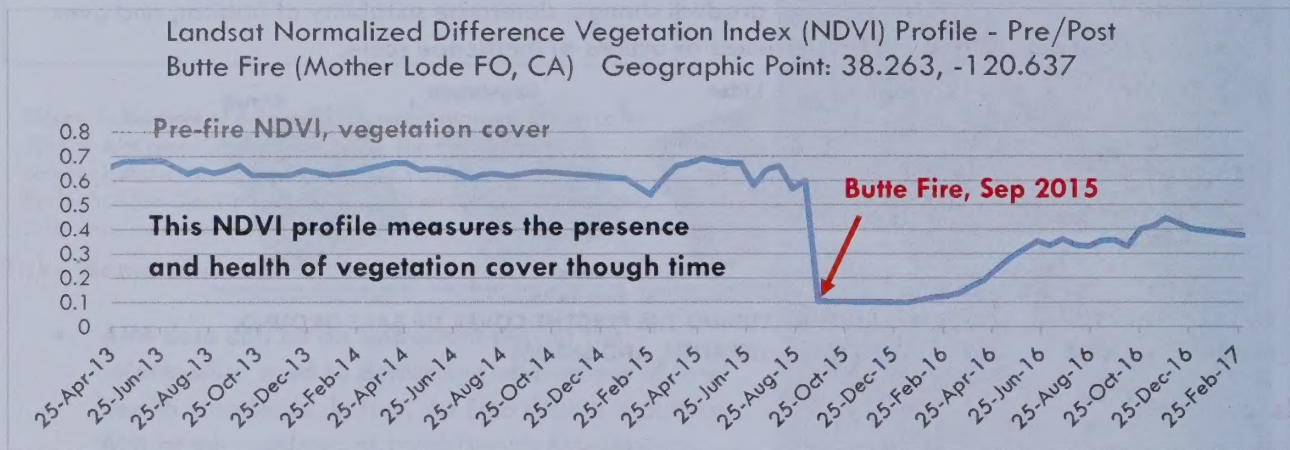


FIGURE 4: TIME SERIES IMAGES AND TEMPORAL PROFILE OF A GEOGRAPHIC POINT WITHIN THE BUTTE FIRE IN CALIFORNIA



Surface Water

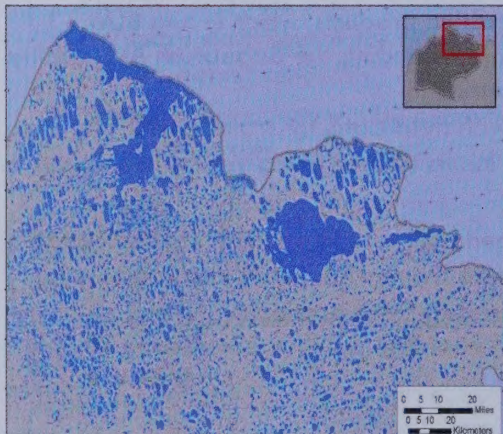


FIGURE 5: SURFACE WATER DERIVED FOR THE NPR-A USING GOOGLE EARTH ENGINE

- Surface water is vital to Western Ecosystems, and represents a challenge to monitor due to this cover type's dynamic temporal and spatial processes.
- Remotely sensed imagery allows the development of seasonal, yearly broad-scale water cover products spanning the National Petroleum Reserve, Alaska (NPR-A)
- Finer scale water cover products to address seasonal surface water cover and availability are derived as needed, based upon field requirements

Parallel cloud computing (Google Earth Engine) is being leveraged to quickly and accurately derive these products in ways not previously practical – or even possible

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